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16. ABSTRACT

This periodical is published to inform air pollution personnel of the Environmental Protection Agency (EPA), and others, of technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given. Translations are cited with their sources whenever possible. The subject fields are as follow: Emission Sources; Control Methods; Measurement Methods; Air Quality Measurements; Atmospheric Interactions; Basic Science and Technology; Effects-Human Health; Effects-Plants and Livestock; Effects-Materials; Economic Aspects; Standards and Criteria; Legal and Administrative; Social Aspects; and General and Miscellaneous. All abstracts are listed under one of the above subject fields. A subject and author index are included. This issue contains abstracts 1 - 687.

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U. S. Department of Health, Education, and Welfare
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CATEGORY SCOPE NOTES

The categories used to organize the "NAPCA ABSTRACT BULLETIN" have been rearranged and changed slightly to permit more effective use. Scope notes for each category are given as a guide to our readers.

Emission Sources - Information pertaining to an industry, process, or material associated with air pollution. Documents in this category are concerned primarily with characteristics of a specific class of emission sources including types, rates, industries; secondary coverage may include effects, control methods, etc.

Control Methods - Includes equipment and both specific source control and general abatement efforts. Included are documents describing the operating principles, design, operation, efficiency, etc., of equipment and methods of removing pollutants from the air. The scope of the document can vary from a device for a specific source to an approach applicable to an entire industry--e.g., automobiles.

Measurement Methods - Includes equipment as well as methods. Confined to development, testing and evaluation of pollutant determination methods (sampling, analytical, monitoring) and equipment, as such. Data obtained by use of methods in specific applications are placed in the applicable subject categories.

Air Quality Measurements - Pollution measurements in the ambient air, generally related to specific geographical locations, such as area surveys. Also includes general reviews of area situations and emission source inventories.

Atmospheric Interactions - All chemical and physical phenomena occurring in the atmosphere. Included is material on dispersion, air pollution forecasts, meteorological effects, topographical effects, photochemical reactions in the atmosphere, etc. Laboratory studies of photochemical reactions fall under Basic Science and Technology.

Basic Science and Technology - General discussion or data compilations for the basic physical and chemical properties of pollutants. Theoretical and laboratory studies on related chemical and biological reactions and mechanisms. Mass transfer and other basic knowledge related to process engineering applications in emission control or abatement. Excludes atmospheric photochemical studies and biochemical studies related to effects of air pollution.

Effects-Human Health - Covers medical and epidemiological studies; biological effects other than those on plants and livestock produced by air pollutants; laboratory animal experiments.

Effects-Plants and Livestock - Effects on vegetation--crops, trees, other plants--and on livestock as distinguished from laboratory experimental animals.

EMISSION SOURCES

Effects-Materials - Deterioration, corrosion, etc., of physical materials, buildings, and structures.

Economic Aspects - Economic implications of air pollution and its control, e.g., economic losses from pollution damage, and costs of control programs or equipment in general.

Standards and Criteria - Recommended or adopted guides, criteria and standards for allowable emission limits or pollutant concentrations, air quality, equipment characteristics, and fuels.

Legal and Administrative - Legal aspects include legislation, ordinances, rules, litigation, hearings, decisions, etc. Administration covers administrative and miscellaneous information concerning control agencies and control and research programs. Typical topics are personnel, budgets, contractual activities and program descriptions.

Social Aspects - Sociological and psychological aspects such as social attitudes, public opinion studies, public relations, and public information.

General and Miscellaneous - Reviews of general problems, trends and background. Documents not assignable to other categories.

1 APTIC NUMBER 17116

Balazova, G., A. Rippel, E. Hluchan, and J. Ambrus
EVALUATION OF FLUOR CONTENT IN LIVING ORGANISM STANDING UNDER THE EFFECT OF FLUOR EXHALATIONS. (Zhodnotenie hladiny fluoru v zivom organizme ovplyvnovanom fluorovymi exhalatmi). Text in Czech. Cesk. Hyg. (Prague), 13(1):12-17, 1968. 21 refs.

Such parameters as air quality, atmospheric fluor content, and content of fluor in dust fall, drinking water, and agricultural products were evaluated in a long-term study carried out in the vicinity of an aluminum plant. At the same time, the fluor content in the teeth, hair, nails, and urine of children living close to the plant was assessed. The mean values of the total fluor content in the air fluctuated from 0.02 to 0.14 mg/F per cu m, and in fallen dust reached up to 7.34 tons of fluor per sq m per yr. The mean fluor content in the drinking water was 0.2 mg/liter. Fluor content in food produced from plants grown in the region fluctuated within 0.5 and 10.0 mg/F/kg, in foods of animal origin within 0.5 and 1.2 mg/F/kg. The fluor content in bones of sparrows, frogs, and rats was two to fourteen times higher than in the controls. The teeth, nails, hairs, and urine of children living in the nearest residential quarter contained an amount of fluor which was twice to three times as large as that of the control children. Examinations in children living in the neighborhood of the plant did not reveal any signs of endemic fluorosis. (Author summary modified)

2 APTIC NUMBER 17076

Belaga, M. B. and P. M. Maystruk
SANITARY PROTECTION OF AIR IN VINNITSA. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:241-246, 1963. (B. S. Levine, ed.) (Also: Gigiena i Sanitariya, 26(1):73-76, 1961.) CFSTI: 63-11570

Plans are presented for the purification of discharges from different shops and departments of a superphosphate plant which currently emits 10.5 tons of sulfur dioxide, 6.5 tons of nitric acid, 1.2 tons of sulfuric acid, 0.5 tons of fluorides, and one ton of superphosphate and tricalcium dust each day. Even at a distance of 2000 meters from the plant, the maximum fluorine concentrations are 13 times in excess of the allowable limit. Similarly, sulfur dioxide concentrations at 1000 meters and sulfuric acid aerosols at 500 meters have been found to exceed allowable limits. The maximum concentration of dust at 200 m from the plant is 15.4 mg/cum, or thirty times in excess of the allowable limit. Dust samples collected at 200-1000 meters from the plant showed a fluorine content of 0.8 to 1.4%. Soil samples at 200, 500, and 1000 meters contained 16.9, 9.61, and 8.7 mg of fluorine per 100 g of soil. Among the measures being taken to reduce pollution are the elimination of gas leaks by equipment hermetization, the installation of dust catching and gas purification equipment, and the construction of high stacks for greater dispersion of pollutants. It is further recommended that the sulfuric acid department build a separate housing for its exhaust fans, use filters to raise tail-gas utilization efficiency, and build a warehouse to store the apatite concentration.

3 APTIC NUMBER 17042

Blanchard, Thomas A. and William F. Morse
FUME INCINERATION RESEARCH. Am. Gas Assoc. Monthly, 51(10):20-23, Oct. 1969. (Presented at the 24th Research, Utilization and Marketing Conference, Washington, D. C., Feb. 23-26, 1969.)

A research facility for developing optimum and unique commercial equipment for industrial fume incineration is described. The facility, which is provided with automatic temperature controls for gas analysis instrumentation, consists of a 5-in. diameter stainless steel tube insulated on the outside. Air is supplied from a blower through a metering orifice to a mixer where the fume or vaporized solvent is uniformly mixed with the main stream. A burner suitable for raising bulk stream temperatures and for performance testing of equipment is mounted in the tube. Leaving the burner, the entire mixture enters the incineration chamber where the degree of incineration along the length of the tube is measured. The equipment can operate at 1600 F on a continuous basis or 1800 F intermittently. The research program has been applied to the development of a full-scale jet-type incinerator which provides both the pumping and mixing energy for adequate incineration. The residence time required for 98% incineration or 2% unreacted hydrocarbons is about 0.12 sec.

4 APTIC NUMBER 16990

Blokh, A. G.
DEGREE OF BLACKNESS OF DUST-CONTAINING GASES IN BOILER INSTALLATIONS. (Stepen' chernoty zapylennykh gazov v kotel'nykh ustanovkakh). Text in Russian. Energomashinostroenie (Moscow), no. 2:24-27, 1967. 7 refs.

The luminosity of boiler-plant combustion products, forming an optically semitransparent diffracting and absorbing emitting medium, depends on the concentrations and emissive properties of the triatomic gases, H2O and CO2, and on the solid particles, preeminently, of ash, carbon, and soot suspended in them. The degree of blackness of the tongue of semiluminous and luminous flames that may occur in combustion chambers of boiler plants can be computed from expressions using the optical density of the two gases H2O and CO2, the ash content of the combustion gases, the ash content of the fuel, the volume of the combustion gas, the temperature of the flame, and the diameter of the ash particles.

5 APTIC NUMBER 16699

British Oxygen Co. Ltd., Glasgow, Scotland
CURRENT METHODS OF COMMERCIAL PRODUCTION OF NITROUS OXIDE. APPENDIX 1. Brit. J. Anaesthesia, vol. 39:440-442, May 1967.

Nitrous oxide is produced on a commercial scale by passing an ammonium nitrate solution through a primary scrubbing tower to a gas-heated reactor. As decomposition takes place, nitrous oxide leaves the reactor, together with steam, ammonia, nitric acid,

nitrogen, and traces of nitric oxide and nitrogen dioxide. Initial cooling of the merging gases causes most of the ammonia and nitric acid to revert to ammonium nitrate, which is returned to the reactor. Residual ammonia and nitric acid are removed by a water scrubber; higher oxides, by caustic/permanaganate scrubbers; and ammonia traces, by an acid scrubber. When free of all impurities except moisture and nitrogen, the gas is compressed and dried in an alumina drier battery. The dry, compressed gas is next liquefied to release nitrogen and evaporate pure nitrous oxide. The evaporated nitrous oxide is then compressed to cyclinder pressure and passed through a second alumina drier battery to a cylcinder filling line. In purity tests for nitric oxide and nitrogen dioxide determination, the gas leaving each drier is passed through a visual bubbler containing an acid potassium permanganate solution and a Saltzman reagent. An alarm is automatically sounded if nitric oxide and nitrogen dioxide concentrations reach 1 vpm.

6 APTIC NUMBER 16685

Chapoux, E.
AIR POLLUTION BY AUTOMOBILE EXHAUST GASES. (La pollution de l'air par les fumees d'automobiles). Text in French. Aspects Tech. Securite Routiere (Brussels), no. 37:2.1-2.50, March 1969. (Presented at the Nov. 28, 1968 meeting of the Belgian Society of Automotive Engineers.)

The chemical reactions taking place in internal combustion engines are presented, together with the principal causes of incomplete combustion, and the consequent composition of their exhausts. The most effective means of fighting air pollution by motor vehicles is to attack its sources, namely: combustion in motors and furnaces, fuel feeds and mixtures, and the like. The Union Technique de l'Automobile, du Motocycle et du Cycle (U.T.A.C.) began its task by determining the concentrations and amounts of carbon monoxide discharged by motors at different engine speeds and fuel-supply conditions, using new and used motors of French and foreign make. In 1960 and 1961, two routes through Paris noted for their dense traffic with many stops and starts were traversed by test vehicles of three power classes riding with the traffic, which were equipped with recording measuring instruments to determine the degree of utilization of the motor at any instant during the trip. The results of these tests suggested the idea of designing a standard test trip in which periods of acceleration, quasi-stationary ride, deceleration, and idling would alternate with predetermined statistical frequencies. Such a test is provided by the 'U.T.A.C. Trip'. To determine the pollutants emitted by motor vehicles in motion, a trailer laboratory was designed. A similar test, using a stand with rotating rollers driven by the car wheels, developed in the U. S. A. is also described. The further development of the U.T.A.C. Trip and a similar test developed in Germany are discussed which have ultimately been merged into a standard 'Europe Cycle' test. Results of Europe Cycle tests made in Germany, England, France, Italy and Sweden on motor vehicles made in these countries as well as in the U. S. A., Holland, and Japan are plotted on two charts showing the emissions of CO and hexane, in grams, during the test cycle vs. the equivalent inertia of the vehicle as well as the respective limiting straight lines worked out by the G.R.P.A. (Groupe de Rapporteurs pourles problemes de pollution par les vehicules) and accepted by the WP29 (Groupe de Travail de la Construction des Vehicules) of Geneva (Switzerland) of the C.E.E. Differences between the European and the U. S. A. procedures are pointed out and discussed at great length.

7 APTIC NUMBER 16766

Charlson, R. J. and J. M. Pierrard
VISIBILITY AND LEAD. Atmos. Environ., 3(4):479-480, July 1969. 8 refs.

Evidence presented in the literature supports the belief that particulate matter emitted in the exhaust of automobiles causes visibility degradation. Since it has been shown that lead is a major component of this particulate matter (30-50 percent by weight as the metal), it appears that control of lead emissions could result in a significant improvement in visibility. Based on the literature, two approaches to the estimation of the percentage of extinction coefficient attributable to lead compounds are discussed. The magnitude of the estimated contribution makes it clear that this is an area of investigation which should be pursued.

8 APTIC NUMBER 16686

Coucke, Edouard
VEHICLE MOTORS AS A SOURCE OF OUTSIDE AIR POLLUTION. (Les moteurs de vehicules en tant que source de pollution atmospherique exterieure). Text in French. Aspects Tech. Securite Routiere (Brussels), no. 32:3.1-3.29, Dec. 1967. 21 refs. (Presented at a conference during the Fourth Belgian National Conference on Pneumology and Phthisiology, 'Air Pollution,' Brussels, Nov. 13-16, 1967.)

This review gives some facts and figures to convey an idea of the extent of air pollution by motor vehicles and to put it into the broader context of the general pollution of the atmosphere, and it indicates the ways in which the problems in this field should be attacked in the order of their practical importance and urgency. The following topics are considered rather briefly: pertinent information regarding Belgium, its population, roads, number of cars, fuel consumption, and network of automobile inspection stations; nature of air pollution by motor vehicles due to exhaust gases, crankcase fumes and motor-fuel evaporation; seriousness of that pollution; exhaust gas composition, estimated annual amount of pollutants emitted by motor vehicles in Belgium and comparison with other sources of pollution; factors influencing pollution by motor vehicles; those independent of vehicle and driver, those dependent on the vehicle, the nature and composition of the fuel, and on human behavior; foreign and international organizations concerned with air-pollution measures and legislation: a simplified recent history of the air-pollution problem in the U. S. A.; measures taken by Belgian authorities against air-pollution and, particularly, to limit smoke emission by diesel motors; current studies and experimental programs. If properly adjusted, maintained and used, diesel motors contribute very little to the general pollution. Carbon monoxide is the principal adversary. One must make sure that Belgian legislation and national

regulations as well as means of control and surveillance never lag behind engineering advances, since, otherwise, products will be exported to Belgium which do not meet the standards established by other countries. The network of roads as well as the streets of Belgian towns must be modified wherever feasible to facilitate the traffic flow. This is one of the best methods of reducing the rate of CO emission which has become dangerously high at certain locations at certain hours of the day.

9 APTIC NUMBER 17131

Crumley, P. H. and A. W. Fletcher
THE FORMATION OF SULPHUR TRIOXIDE IN FLUE GASES. J. Inst. Fuel, 29(187):322-327, Aug. 1956. 16 refs.

The factors controlling the oxidation of sulfur dioxide (SO2) to sulfur trioxide (SO3) in the combustion of fuels containing sulfur were investigated in a small kerosene-fired furnace. The SO3 contents of the flue gases from the furnace were determined chemically, and were shown to depend on the sulfur content of the kerosene, the flame temperature, the amount of excess air, and the type of flame. The SO3 content of the flue gases from a large oil-fired boiler was also determined and compared with the results obtained in the small furnace. The concentration of SO3 increased with the sulfur content of the fuel; but as the sulfur content increased, the rate of increase of SO3 concentration fell off. The percentage oxidation of SO2 to SO3 fell in a corresponding way and over the range of sulfur contents investigated (0.5 to 4.0%), decreased from 5.0 to 3.2%. It has sometimes been suggested that above a certain sulfur content, the amount of sulfur in the fuel will have little effect on the amount of SO3 in the flue gases. This suggestion is not confirmed by the present results, at least over the range of sulfur contents found in commercial fuels, and it therefore seems likely that trouble due to SO3 will continue to increase with sulfur content up to the highest values found commercially. The reason for the initial increase in SO3 production with flame temperature is most probably due to an increase in the concentration of oxygen atoms in the flames at higher temperatures. This would be expected to lead to an increase in SO3 production; the fact that increase of temperature tends to push the equilibrium to the left may be unimportant, since equilibrium conditions do not exist in a flame. It may be noted that the results can hardly be due to variations in the time of residence in the high-temperature zone, since the time of residence would not be expected to vary greatly with flame temperature. The similarity of the results obtained with kerosene and distillate fuel oil suggests that the effect of flame temperature on SO3 production may be general. The reason for SO3 production with the 3% sulfur distillate fuel being less than with a 3% sulfur kerosene has not yet been established, but it is likely that SO3 production will always tend to be lower with heavy fuels than light fuels. Such an effect would be expected, since with heavy fuels there is a tendency to obtain incomplete combustion, known to suppress SO3 formation. This is shown by the results from the large industrial boiler burning heavy fuel oil containing 3.7% sulfur, where the SO3 content of the flue gases was lower than that obtained with kerosene of similar sulfur content.

10 APTIC NUMBER 17198

Endo, Ryosaka
RESEARCH ON THE SOURCE OF ODOR DEVELOPMENT AND THE RESIDENTIAL REACTION IN HOKKAIDO. (Hokkaido ni okeru akushu no hasseigen to junin hanno). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(4):209-220, April 15, 1968. 23 refs.

The results of an empirical field survey of odor sources are presented. Residents of Hokkaido were sent olfactory test questionnaires and asked to identify the source of an odor, its degree, and its variation with time and season. The residents lived in an area of fish processing plants, oil and fat works, excrement-disposal facilities, paper mills, crematories, incineration plants, refuse dumping sites, and fox-breeding kennels. The returns, which amounted to 1,023,348 identifications of an odor source, were centered on fish-processing plants. This means that they are the major source of an odor problem affecting an estimated 218,300 persons. Next in order of importance were paper factories, incineration plants, agricultural processing plants, and animal breeding buildings. Of the fish-processing plants, the most offensive and noxious odor was produced by fertilizer made from fish flesh, fish oil, and other fish refuse. The major odors were generated in gas emissions from boiling and drying operations. Following the olfaction survey, the quantitative odor measurements and chemical analysis of odor components were undertaken in fishery fertilizer-processing plants. Volatile organic acid was observed to occupy the greatest proportion of offensive odors of fish fertilizers followed by ammonia, amines, mercaptans, and sulfurous acid.

11 APTIC NUMBER 17304

Focke, Rolf J.
TOXICITY OF AUTOMOTIVE EXHAUST GASES. (La toxicidad de gases de escape en automotores). Text in Spanish. Ingenieria (Mexico City), no. 1004:17-27, 1969 (?). 6 refs.

A total survey of the auto exhaust problem is made for a nontechnical readership. Gasoline additives used to dissolve lead deposits in motors cause the formation of lead bromide and lead chloride, which evaporate at 800 C and could therefore cause air pollution. About 15% of all hydrocarbon vapors can be traced to the evaporation of fuel from tanks and carburetors. Crankcase ventilation is the source of about one third of all hydrocarbon pollutants. To prevent the formation of carbon monoxide, a stoichiometric mixture of air and fuel would have to be used: about 14.5 kg of air for each one kg of fuel; however, best effects are obtained with a rich mixture (lambda value equals 0.8-0.9), while the best fuel economy is obtained with a lean mixture (minus lambda equals about 1.1, with an allowance of 10-12% for power leakage). A further difficulty is the presence of unevaporated droplets of fuel, whose distribution is irregular from cylinder to cylinder. An investigation of the automotive pollution problem in the USA in 1962 cost 14 million dollars, of which the Federal and state governments contributed 9.8 million and the universities, 0.5 million, the rest coming from industry. By 1963, the cost of the investigations had reached 22 million. During 1962, the damage in the USA caused by this pollution amounted to 11

billion dollars.

12 APTIC NUMBER 17006

Commission of European Communities, Luxembourg (Belgium), General Management of Coal
COOPERATION BETWEEN C.E.C.A. AND THE U.S.A. (COOPERATION C.E.C.A.-U.S.A.). Document No. 4894/1/67 f, 6p., Sept. 29, 1967. Translated from French. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 8p.

The exchange of information, collaboration, community studies on subjects about which the United States could be informed or the results of which could be communicated to it against renumeration or payments, and American research about which the community would desire to have more information than in the past are covered. A summary of the various documents tendered by the American delegation (U. S. Bureau of Mines, Bituminous Coal Research Association, and the U. S. Office of Coal Research) and various proposals of the French, Belgian, and German delegations is compiled. Exchange of information includes the following topics: utilization of low-temperature tars and pitches; improvement of small furnaces operating on grain fuel; transport of coal in ducts; and improvement of the new firebricks. Collaboration includes the following topics: mechanical preparation of coal; utilization of fly-ash and washing slate and other mine residues; combustion methods; and fundamental research into chemistry and physics of coal and coke. Community studies contain the following topics: oxidation of coal and its agglomerates; coking; production of soluble oxidized coal; production of active coal; combustion methods; and capturing methane. American research includes the following topics: preparation of coal; carbonization at low temperature; liquefaction and gasification of coals; carbochemistry; and direct transformation of energy.

13 APTIC NUMBER 17190

Hasegawa, Toshio
ON THE OUTLINE OF FUEL CONSUMPTION, INSTALLED BOILERS AND OTHER FURNACES IN OSAKA PREFECTURE. (Osakafu ni okeru bainen hassei shisetsu to nenryo shohiryo no gaikyo). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(4):221-226, April 15, 1968.

The general status of fuel consumption of boilers and industrial furnaces in Osaka is described. The number of boilers and furnaces now in use indicates an increasing reliance on fuel oil as an energy source. Due to current improvements, newly installed boilers and furnaces show high rates of heat efficiency and thus high combustion rates. Classification of Osaka's 8317 boilers and 400 industrial furnaces in terms of their material composition indicates that 1173 furnaces consist of metal heating; 662, of reverberatory furnaces; and 534, of fusion furnaces. Some of these present problems related to smoke dust emission control. Specifically, the electric furnaces, iron fusion furnaces, glass fusion furnaces, and lead or aluminium fusion furnaces that are used by relatively minor plants, present financial and technical difficulties. This is in contrast to large plants which independently practice smoke dust control. Fuel oil consumption has increased markedly in the past seven years in Osaka, with the 1966 sale of heavy oil nearly four times that of 1958. Data from a survey of the relationship between fuel consumption and air pollution show that the total quantities of coal burned and heavy oil consumed was 1586.8 ton and 921.0 kl in the first three days of 1968; the daily average quantity used during the preceding December was 5399.8 tons and 2236.9 kl. Sulfurous gas density equivalent to fuel consumption showed a proportional increase in the three days when very small plants were operative.

14 APTIC NUMBER 17237

Honda, Junyu
ORIGINAL SOURCES OF INDUSTRIAL REFUSES. (Sangyo haikubutsu no seibun). Text in Japanese. Shigen (Resources), no. 175:15-18, Dec. 5, 1969.

Fundamental problems of refuse disposal are discussed. Refuse can be classified by primary, secondary, or tertiary industries in addition to refuse from city reconstruction and environmental consolidation projects. All these different kinds of refuse require necessarily different types of disposal and treatment. Refuse from primary industries include low-quality coal, rice-straw rubbish, vegetation rubbish, vinyl material refuse, livestock excrements, timber or lumber chips, fishery and shell-fish refuse, etc. Oily refuse, oil pitch, carbide-bearing refuse, potter's clay refuse, sludge, clinker, glass material refuse, and ashes generally belong to the secondary industrial refuse group. Comparatively combustible refuse is characteristic of the third industry group. Collection of refuse is not commerically profitable due to its mass and diversity. The same is true of both primary and secondary industrial refuse which, until a few years ago, was sold as compost for soil improvement and as fertilizer or disposed of by private open burning or simply open dumping. As industrial refuse becomes massive and diversified, and the labor force required for its collection declines, these previous disposal methods are no longer practical.

15 APTIC NUMBER 16970

Ingulstad, A.
AIR POLLUTION DUE TO AUTOMOTIVE EXHAUST. (Luftforurensning fra motorkjoretoyer). Text in Norwegian. Tekn. Ukeblad (Oslo), 113(2):26-30, Jan. 13, 1966.

According to a study made in Paris, 25% of all air pollution is from automobile exhaust. A comparison of present-day gasoline motors with those used in 1955 shows an increased gas mileage and low carbon monoxide content, in the order of 20-30%, due mainly to the reduction of cylinder size. Gasoline motors can be designed in which the fuel is sprayed directly into the cylinders, as in diesel motors. The gas feed of such a system would be more sensitive to changes in speed. Several carburetors can also be used. Exhaust gases can be purified by the use of a catalyst or by afterburning. The presence of lead in the gasoline is a serious handicap to the use of a catalyst; an afterburner presupposes sufficient unburned material and air to support combustion. All the above systems are too expensive at present for use in passenger cars. In Norway, there are about 24,000 diesel

vehicles, or about 3% of the total vehicles in use, as compared with 0.35% for the United States. A properly adjusted and maintained diesel motor should cause less air pollution problems than those run by gasoline, since combustion occurs with an excess of oxygen. But it is common knowledge that many diesel vehicles emit an ugly and evil-smelling exhaust. The problems are caused by: 1) too heavy an injection of oil, 2) damaged or burnt-out valves, 3) an improperly installed regulator, 4) improper timing of the injection, or 5) a clogged-up air filter. In mountainous Norway, where maximum power is needed on the steep hills, the temptation is to tamper with the injection and timing, setting them differently from the specifications of the manufacturer. The small advantage thus gained is soon neutralized by the problems arising from the improper settings, and diesel motors are given an undeservedly bad reputation. Also, diesel trucks equipped with turbines release a puff of black smoke when starting up from the idling position, this being the fault of the turbine, which supplies insufficient air to the motor until the rpm's have increased accordingly. Norwegian police have spot-inspected several thousand diesel vehicles; 30-40% were so improperly adjusted that the exhaust output was unacceptable. Motorists are being educated to eliminate unnecessary idling of motors, unnecessary quick stops, and rapid acceleration.

16 APTIC NUMBER 16802

Jones, H. P.
COMPARATIVE STUDIES OF BUTANE, PROPANE, AND A COMMERCIAL L.P.G. AS ENGINE FUELS. J. Inst. Fuel, 42(341):240-244, June 1969. 5 refs.

Full throttle performance characteristics are given using in turn butane, propane and a commercial L.P.G. The compression ratios used were 5.5, 7, 8, 9, and 10. Specific fuel consumption curves are plotted for all three fuels at each compression ratio. The exhaust gas was tested for CO content at maximum power and at maximum economy conditions taken from the specific consumption curves. The CO content in the exhaust was found to be lower in all cases than that normally obtained from engines running on petroleum fuels. (Author's Abstract)

17 APTIC NUMBER 17280

Koutnik, Joseph and Jan Vratny
CONTRIBUTION TO THE PROBLEM OF AIR PURIFICATION IN THE NORTH - BOHEMIAN LIGNITE COAL MINES. (Prispevek k reseni problematiky cistoty ovzdusi v Severoceske hnedouhelne panvi). Text in Czech. Uhli, 11(6):218-221, June 1969. 3 refs.

The changes due to a change of coal with a low content of sulfur during an inversion period was studied at power plants. The climate of a very stable boundary layer was divided into three main types. A very stable boundary layer was defined as one that spreads between the earth's surface at an altitude no higher than 2 km/1,25 miles, characterized with a small positive vertical gradient from the earth's surface to the altitude of 800 m/3200 ft. Individual power plants were evaluated with respect to coal consumption and power. It is suggested that during the period of inversion, as announced by the Weather Bureau, the power plants use the fuel with the lower content of sulfur.

18 APTIC NUMBER 17243

KUSUMOTI, MASAYASU
SOME PROBLEMS IN REFUSE DISPOSAL. (Haibutsu shobun no mondaiten). Text in Japanese. Yosui to Haisui (J. Water Waste), 11(8):619-621, Aug. 1, 1969.

Disposal of refuse, solid or liquid, does not imply complete solution of the refuse problem, although some refuse is partly reduced to energy by incineration and partly dispersed to the atmosphere in an aerosol state. Human productive activities are closely linked to the metabolic processes by which nature provides raw materials and other substances for consumption, and as long as men remain within the metabolic cycle the balance between nature and productive activities is maintained. In highly industrialized societies, this equilibrium is lost. For example, in the process of pulp manufacturing, nearly 4 tons of refuse is processed per 1 ton pulp, while in the second process of paper production, 13% of refuse is produced per total amount of pulp. What is finally collected as paper is about 40%; the remaining 60% is refuse. The concept of refuse disposal as a transitional process in which refuse is conveyed to the cycle of metabolism and then returned to nature may not be a reliable one. It appears more promising to dump refuse in the ocean or to utilize it for land reclamation by composting or fertilization even though these solutions involve problems of large scale collection and transportation. Studies bearing on technical aspects of composting and land reclamation are sufficiently developed to suggest that composting is the most practical countermeasure for refuse disposal.

19 APTIC NUMBER 16691

Ladu, M., M. Pellicioni, and M. Roccella
PRODUCTION AND DISCHARGE OF TOXIC AND RADIOACTIVE GASES IN THE 'LINAC' TUNNEL IN FRASCATI. (Produzione e scarico di gas tossici e radioattivi nel tunnel del Linac di Frascati). Laboratori Nazionali di Frascati del CNEN, Italy, LNF-65/21, Nota interna: no. 282, 12p., June 28, 1965. 8 refs. Translated from Italian. National Research Council of Canada, Ottawa, National Science Library. T.T. 1332.
CFSTI: N 69 10248

Among the hazards associated with high-power linear accelerators are the production of NO2 and O3 plus the nuclides O 15, N 11, and Cl 38. For the sake of production and the safety of personnel, production of the gases and nuclides in the Frascati Linac tunnel was calculated. Results show that the maximum allowable concentrations of the gases are reached in approximately 20 min. If the air in the tunnel is changed every 10 minutes, concentrations can be kept below the admissible levels. This can be accomplished by ventilation on the order of 60 cu m/min. Production of the nuclides is less than 20% of the allowable maximum, which for lungs is 4 rem in 13 weeks, corresponding to the value 7 to 0.001 rad/hr for 40 hrs/week. Radiation levels at points where radioactive gases are discharged do not appear to be serious.

20 APTIC NUMBER 16722

LaMantia, Charles R. and Edwin L. Field
TACKLING THE PROBLEM OF NITROGEN OXIDES. Power, 113(4):63-66, April 1969. 9 refs.

The National Air Pollution Control Administration (NAPCA), an agency of HEW, is now sponsoring a program to define sources, magnitude, and character of the nitrogen oxide problem, and to consider various methods for the control of NOx emissions from stationary sources. NOx emissions are objectionable because of the brownish color that nitrogen dioxide gives the atmosphere, and also because of their tendency to promote formation of the photochemical smog generally associated with automobile exhaust, resulting in various eye-irritating compounds such as formaldehyde, acrolein, and peroxyacyl nitrates. The sources and emission factors of NOx and various approaches to control, destruction, or removal are discussed.

21 APTIC NUMBER 16847

Marchesani, Vincent J., Thomas Towers, and Henry C. Wohlers
MINOR SOURCES OF AIR POLLUTANT EMISSIONS. J. Air Pollution Control Assoc., 20(1):19-22, Jan. 1970. 24 refs.

Emission source inventories for air pollutants have considered major categories such as transportation, domestic heating, electric power generation, refuse burning, industrial fuel consumption and process emissions, as well as commerical, institutional, and governmental space heat fuel burning. Not considered in such emission inventories are sources such as aerosol spray cans, ground dust, leaf burning, cosmic dust, crop dusting, perfumes, smoking, marsh gas, and tire tread wear. This paper investigates and evaluates such minor emissions on a population density or land area basis. These minor pollutant sources have been overlooked in the past because of their assumed negligible emissions. However, some potential pollution problem areas were encountered when an appraisal of the minor pollutant sources was performed. It is the intention of this paper to point out these potential problem areas in a segment of the air pollution field seldom considered. (Author's Abstract)

22 APTIC NUMBER 17065

Ministry of Health and Welfare, Tokyo, Japan, Bureau of Environmental Sanitation
ABSTRACT OF TEMPORARY MEASURES FOR ENVIRONMENT POLLUTION DUE TO CADMIUM. (Kadomyumu ni yoru kankyoosen zentei taisaku yoryo). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(11):932-935, Nov. 15, 1969.

The effect of cadmium on the human body is currently recognized, as is the extent of natural sources of cadmium. Some quantity of cadmium is inevitably present in drinking water, food, and air. For this reason, more emphasis needs to be placed on its cumulative effect on the initial period of its absorption rather than on its density, since cadmium reveals its effect only when the accumulated total becomes crucial. The Ministry of Public Welfare is sponsoring research in fields where cadmium pollut. is obviously prevelant and has issued basic directives pertain. to research activities. According to these, artificial source of cadmium are mining, refinery, cadmium gilding, and cadmium battery works. Because cadmium coexists with lead in the ore state, lead refining and lead and cadmium mining are also included. Research procedures include investigations of cadmium-containing waste water and stack smoke, the assignment of priorities to each area under influence of lead and cadmium on the basis of density grade, and analytical studies of selected samples. These projects are under the supervision of the administrative office concerned. Public health measures include periodical physical examinations, health clinics, dietary guides, etc. If an average cadmium intake in excess of 0.3 mg is found among a group of people, well water, drinking water, and agricultural products are checked; the local water supply office assumes responsibility for drinking-water investigation and the local agriculture and forestry office for agricultural products. Mining and refinery operations are supervised by local branches of the Ministry of Industry and International Trade.

23 APTIC NUMBER 16953

Mueller, H.
THE CARBON MONOXIDE CONCENTRATION IN THE AIR OF A ROOM WHERE A GAS APPLIANCE IS BEING USED. (La teneur en monoxyde de carbone dans l'atmosphere d'un local lors de l'utilisation d'appareils a gaz). Text in French. PART I. Gaz, Eaux, Eaux usees, 49(2):54-58, 1969. Part II. Ibid., 49(3):82-88, March, 1969. (Also: German edition, Bull. Mens. SSIGE, nos. 3 and 4, 1968.)

When a gas-burning apparatus with no provision for exhaust is used in a room, the circulation of fresh air must be sufficient to prevent formation of a dangerous concentration of carbon monoxide. Lack of ventilation allows burned gases to accumulate and lets the oxygen content of the air become depleted, encouraging incomplete combustion with further formation of CO. The rate of exchange of air through vents or windows in the door of an otherwise airtight room was studied. Results corresponded to the formula: n(o) equals Q/V, where n(o) is the index of exchanged air which indicates how many times an hour the volume (V) of the room is replaced by the volume (Q) of fresh air. The index, n(o), also equals 1.4 times the square root of the vent area divided by V. Heating in the room or leakage can increase this value by 30-70%. Experiments on CO generation were made on small water heaters without combustion gas exhaust and on heaters consuming liquefied natural gas. If propane or propane-air mixtures were burned, dangerous concentrations of CO were produced in 15 min, even with considerable ventilation. The maximum oxygen concentration at which CO was generated was determined as 20% for the propane burners. A limit of 16% or more oxygen was recommended for eliminating CO. City gas-burning apparatus satisfied this limit, but those using propane or natural gas did not. The vent area necessary to prevent the oxygen content of the air from falling below 16% can be calculated knowing the heating rate of the appliance and the size of the room. For apparatus not satisfying the limit, a device to cut off the gas supply when the oxygen content of the air falls below a certain point or means of removing the waste gases should be added.

24 APTIC NUMBER 17171

Myers, Phillip S.
NATION'S COST/BENEFIT RATIO WEIGHS HEAVILY ON AUTO EMISSIONS. S. A.E. (Soc. Automot. Engrs.) J., 78(3):20-27, March 1970. 1 ref.

The urgency and size of the automotive air pollution problem, solutions to the problem, and effect of controls on the problem were discussed. Man-caused additions of pollutants to the atmosphere are large with respect to natural contributions for particulate matter and hydrocarbons. Man already produces almost all the carbon monoxide, 90% with autos. The only oxides of nitrogen that are significantly man-caused are nitric oxide and nitrogen dioxide. These two represent only a small fraction of the total nitrogen compounds. Sixty per cent of the pollution in the United States comes from automobiles alone. One obvious source is blowby past the rings. However, most cars are equipped with PCV valves which eliminate this source in well-maintained cars. The largest contributor is the exhaust, both in quantity and smog forming potential. Nitrogen oxide and carbon monoxide form in the bulk gases; hydrocarbons are formed in the quench zone. Nitrogen oxides are controlled by recycling the exhaust or by burning a mixture that is either quite rich or quite lean. A rich mixture is undesirable; it increases CO and unburned hydrocarbons. It is difficult to burn a mixture lean enough to decrease NO to the desired level. One combination would be to run rich, then destroy the HC and CO in the exhaust system. This plan could be expanded to include two-stage combustion, but at a sacrifice in fuel consumption. Other solutions were presented. It takes 3 to 5 yrs to place a technologically feasible control technique involving significant modifications into universal mass production. There is an additional time lag of 4 to 7 yrs to equip enough cars with the control device so that noticeable reductions occur. Ultimately, it will be simple economics: what is the cost/benefit ratio for further reductions compared to steam, turbines, stirling engines, batteries, and fuel cells.

25 APTIC NUMBER 17236

Nakamura, Naohiko
UTILIZATION OF REFUSE COMPOST. (Konposuto no riyo). Text in Japanese. Shigen (Resources), no. 175:19-21, Dec. 5, 1969.

Two potential merits of refuse compost are discussed. Refuse compost improves humus more effectively than conventional compost of which the dominant components are ricestraw rubbish and other refuse common to farming. From an eight-year investigation of the effect of refuse compost fertilization on vegetation, it was determined that the remaining rate of humus soil in an underground refuse compost is higher than that in ricestraw compost. Refuse compost is appropriate for soil deficient in organic matter or in B, Mn, Mo, and Zn, since it is enriched in these minerals after being composited in many different types of soil. In addition, refuse compost generally contains a considerable amount of lime, which makes it suitable for reforming the acid soil in Japan. In spite of these advantages, the use of refuse compost is not widespread in Japan, partly because its benefits are not understood and also because city refuse treatment facilities are directed toward incineration. As a consequence, the prevailing method of refuse treatment results in compost which is not sufficiently fermented, often odorous, or injurious to vegetation when utilized for soil improvement or farming. Refuse compost can be also applied to green zones in cities and used for many other purposes if it is of enriched quality. Results of laboratory research on the effect of refuse compost application on eggplant, tomatoes, cucumbers, and cabbages are reported.

26 APTIC NUMBER 17017

Nikolaev, S. P. and S. A. Dymshits
DISCHARGES OF BOILER OPERATED (COAL BURNING) PLANTS CONVERTED TO GAS BURNING. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:93-96, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

To evaluate the efficiency of shale gas combustion chambers, discharge gases from six chambers were analyzed for sulfur dioxide, hydrogen sulfide, tarry substances, soot, element composition, and caloric value. The SO2 content of the gases ranged from 3.04 to 207.06 mg/cu m and the H2S content, from 0.46 to 4.67 g/100 cu m of gas. Products of incomplete combustion were CO, H2, and CH4. Tarry substances ranged from 0 to 32.61 mg/cu m. The soot present in the gases was in a high degree of dispersion. Caloric value of the gas was 3234 to 3576 cal/cu m in the morning and 3178 to 3632 cal/cu m in the afternoon. A statistical study of the data gathered in 19 discharge analyses indicated that incomplete combustion occurred frequently in the chambers. This is attributed in part to faulty chamber construction, inappropriate chamber size, changes in composition and pressure of the gas fuel, absence of control devices, and shortcomings of technical personnel.

27 APTIC NUMBER 17325

Odaira, Toshio
AUTOMOTIVE EXHAUST EMISSIONS IN THE METROPOLITAN TRAFFIC IN VIEW OF AMBIENT AIR POLLUTION --- IN TOKYO. (Kankyo osen kara mita daitoshi ni okeru jidosha haiki gasu ni tuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(2):109-117, Feb. 15, 1966.

An analytical investigation was undertaken of the effect of each component of auto exhaust gas on air pollution. Components of auto exhaust gas can be divided into those related to imperfect combustion and those indifferent to imperfect combustion. Gasoline oil is perfectly reduced in water, carbon monoxide gas, and a small amount of ashes with the proper supply of oxygen, relevant temperature, and time; but in actuality, it produces carbon monoxides and hydrocarbons by imperfect combustion. Compounds indifferently generated by imperfect combustion are nitrogen oxides, sulfur gases, and lead. One of the effects of nitrogen oxides on air pollution is currently recognized as an important constituent of photochemical smog which is caused by the existence of ultraviolet light, which nitrogen oxides can remain as nitrogen dioxide in a stable atmosphere. Crude oil, natural gas, and coal are the major hydrocarbon containing materials whose sources are petrochemical plants and motor vehicles. Carbon monoxide emissions, which are largely responsible

for air pollution in cities such as Tokyo, need to be controlled by technical devices or improved engine systems. Lead compounds have a relatively long lifetime, accumulating in the bodies of individuals constitutionally predisposed to chronic lead poisoning. The major source of lead had been lead plants and steel plants, but the recent increase of lead compounds in polluted atmospheres has been caused by the increasing number of motor vehicles using gasoline with lead additives.

28 APTIC NUMBER 17252

Odaira, Toshio, Sadao Imano, Saburo Fukuoka, and Yoshihide Agata
QUALITIES OF THE PARTICLE EMITTED FROM STEEL MANUFACTURING ELECTRIC FURNACE. (Seikoyo denkiro no baien no seijo). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(5):26-27, June 15, 1966.

An electromelt furnace was investigated by the Japan Industrial Standard method (Z-8808, K0103). A small bag filter and a cascade impactor were used as the precipitators. A smoke cylinder (2.4 m in diameter) was placed 5 m above the furnace. The mean velocity of exhaust gas was 3.5 m/s; during the oxidizing period, it was 1 m/s and during the reducing period, 2.5 m/s. The amount of gas measured was 40,000 N cu m/hr, and 22,000 N cu m/hr, and showed that the attenuation is more than 90% and 95%, respectively. The quantity of particles 5 m above the furnace were about 4.5 g/N cu m and 1.5 g/N cu m; at the generated point, it was estimated to be about 55 g/N cu m and 50 g/N cu m, respectively when diluted. The distribution of the diameter of the particles gathered by the bag filter, both in the oxidizing and reducing period, indicated that one-half of the particles (by weight) were less than 10 micron in diameter. Particles of the oxidizing period in the cascade impactor were spheres, 0.1-1.0 micron in diameter, which is one-half the diameter of the particles in the reducing period. Plans for smoke installations must be investigated in view of fine particles.

29 APTIC NUMBER 16180

Odaira, Tozio
THE PRESENT CONDITION OF FUEL QUANTITY FOR SALE AND AIR POLLUTION IN TOKYO (II). (Tokyoto niokeru nenryoshiyo to taikiosen no suii (II). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(12):767-773, Dec. 15, 1968. 3 refs.

The change in the nature of air pollution of Tokyo, as based on SO2, CO, and dust fall measurements in representative areas, is discussed. The sampled areas were the Ota district, a typical industrial area; the Chiyoda district, a leading business area; and the Shinjuku district, a residential area. Measurements in the Ota district reflect its proximity to heavily polluted Kawasaki city. Central heating boilers are the major source in pollution in the Chiyoda district, with pollution greatest in winter. This district also has the highest level of automobile exhaust emissions. The measurements show that, due to the transition from coal to petroleum, sulfur dioxide concentrations have increased at an accelerated rate since 1964. On the other hand, atmospheric dust and dust particles are declining. The dust fall measurements support the conclusion that the change in energy source is the cause of the change in pollution status.

30 APTIC NUMBER 17255

Osaka Municipal Office, Japan, Dept. of Public Nuisance Countermeasures
AUTOMOTIVE EXHAUST EMISSIONS IN THE METROPOLITAN TRAFFIC IN VIEW OF AMBIENT AIR POLLUTION -- IN OSAKA CITY. (Kankyo osen kara mita daitoshi ni okeru jidosha haikigasu ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(2):119-128, Feb. 15, 1966.

Air pollution by motor vehicles and the density of the polluted ambient air in Osaka was discussed. A great proportion of the air pollution is caused by an increase in motor vehicle traffic. The number of traffic delays were reported. These numbered (in terms of a length of 500 m of cars in 30 minutes time) 3602 in 1963 and 4565 in 1964, showing an increase of one and a half times from 1963 to 1964. Unless controlled, traffic delay will last and ambient air will become more polluted. Traffic delays accompanied with repetition of acceleration and deceleration results in the wasting of fuel and increases exhaust gas emissions. Since drive speed coincides with exhaust gas density, traffic conditions in Osaka were interpreted as the worst harmful condition to drivers. In view of these traffic circumstances, the placement of automotive exhaust gas monitoring stations in six places on the highways within the city was planned. A field study on the atmospheric dispersion of automotive exhaust gas by seasons at 50 places surrounding the main highways was also planned, along with a medical survey the effect on the regional residents.

31 APTIC NUMBER 17199

Oshio, Toshiki
AIR POLLUTION PROBLEMS IN JAPAN (I). (Nagakuni ni okeru taiki osen to sono mondaiten (I)). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(4):197-208, April 15, 1968.

It is known that air pollution grows more serious where various types of industries are concentrated in one area. The coastal industrial area in Japan is typical in this respect: the recent tendency of plants to locate on, or adjacent to the coastline is particularly reflected in locations of petroleum refineries and petrochemical plants associated with iron and steel refineries or with thermal power plants for whom coastal areas provide shipping advantages. The difficulty of shoreline air pollution control lies in the diversity of industries involved. Factors associated with different pollutants generated by individual plants must be investigated to determine the collective effect of combined pollutants. For example, where heavy oil is burned, the determination of the air-pollution load in the immediate area is based on multiple density, which is the product of the total quantity of exhaust gas emission and respective density of each pollutant. In addition, several major types of effects of the concentration of air pollutants after they leave emission sources should be taken into consideration. Dispersion of pollutants depend on the effective emission height of the chimney, efflux velocity, wind speed, and other geographical conditions which complicate the behavior of

atmospheric pollutants in coastline areas. The major sources of sulfurous gases are the thermal power plants, iron-steel refineries, petroleum refineries and petro chemical plants, but there are additional pollutants which make the pollution density thicker. Since sulfurous gas alone may be less important in qualitative and quantitative respects, other combustion products, such as metal sulfides or sulfates generated in iron-steel plants, need to be considered in shoreline pollution abatement programs.

32 APTIC NUMBER 16760

Rogers, Leslie C. and D. H. Stormont
FEARS OF LOW-SULFUR RESID SUPPLY CRISIS EVAPORATING. Oil Gas J., 67(28):29-33, July 14, 1969.

Supplies of 1 percent sulfur resid appear to be adequate for the East Coast demand mainly due to an abundance of sweet African crude and resid fractions. Supply will expand rapidly toward 1970 as a number of new Western Hemisphere desulfurizing plants come on stream. These facilities will also meet the demand for 0.3-0.5 percent sulfur resid that will result as more stringent air pollution curbs take effect. In addition to the approximately $300-million desulfurizing program underway in the Caribbean, installations in East Coast plants have been proposed.

33 APTIC NUMBER 17222

Rowe, D. R. and L. W. Canter
CAN THE CAR FOR POLLUTION? J. Environ. Health, 32(4):413-417, Jan./Feb. 1970. 32 refs.

The effect of engine operating conditions on the composition of auto exhaust is discussed and a comparison is made between automobile and diesel engine exhaust. Diesel engine exhaust is high in nitrogen oxides and particulates, while automobile exhaust is high in carbon monoxide and hydrocarbon emissions. An overall 95% reduction in automobile emissions is expected by 1980, including a 93.3% reduction in nitrogen oxides. With control devices, crankcase, fuel tank, and carburetor emissions should be completely eliminated. Work on devices to treat exhaust gases show that they are expensive and present problems of road life and maintenance. The afterburner, although efficient, is costly, and catalysts have a dependable life of only about 15,000 miles, after which they are rapidly poisoned by lead. Current instrumentation for monitoring automobile exhaust is expensive, complex, and requires highly trained personnel. The investigations being conducted by the National Center for Air Pollution Control on better measuring devices and alternative power systems should assist in the development of long-range plans for controlling pollution from conventional automotive systems.

34 APTIC NUMBER 16775

Russell, W. E.
AIR POLLUTION AND CHEMICAL INDUSTRY. Clean Air (J. Clean Air Soc. Australia New Zealand), 3(1):15-23, 25, March 1969. 17 refs.

Sources of air pollution from the chemical industry in New Zealand are discussed. Noxious or offensive gases, liquid droplets or fumes, smokes or particulate matter, and dust must be controlled. Methods available for dealing with waste gases are discussed and examples are given that demonstrate that improvements in plant efficiency have greatly reduced air pollution. Recovery systems, principally for SO2, are described. A brief summary is made of theoretical predictions for dispersion where other methods have failed.

35 APTIC NUMBER 17174

Safford, Donald E.
BURNER CHANGES VS. FUEL CHANGES. Hydrocarbon Process., 49(2): 99-100, Feb. 1970. 2 refs. (Presented to the Air Pollution Control Association, New York, June 1969.)

Smoke emission is the most objectionable problem in the combustion of residual fuels. Today's modern burners, properly adjusted, can produce practically a theoretical carbon dioxide with no visible sign of emissions other than heat diffraction waves coming from the stack. Good air-fuel mixing is necessary. Other factors critical for clean combustion are the fuel viscosity at the burner, the ability of the burner to hold the flame in a stable position, flame consolidation, and sufficient flame travel before touching a relatively cool surface or atmosphere. Droplet size is important, since the droplet must vaporize before the fuel will burn. When droplets are too large, they pass through the flame in the liquid stage, spattering on relatively cool surfaces causing smoking, inefficient combustion, and the build-up of coke trees. The greatest aid to reducing air pollution from oil firing is preheating to obtain a low oil viscosity at the burner. An added benefit of higher preheat is the shortening of the flame. Pulsation was a plague of residual equipment and was cured through the use of flame-holders or stabilizing devices located in the proximity of the burner nozzle. Fuel properties were also discussed. Most of the low-sulfur residual fuels come from paraffinic type crudes. Paraffins may have a melting temperature of 100-110 F which makes a type of preheat ahead of the suction line strainer to prevent wax plugging of the strainer desirable. The No. 6 fuels require preheating in a tank to a range of 130-140 F for pumping, and the possible wax precipitate is automatically melted. The high-melt, 110-130 F, low sulfur fuels require provisions for heating the entire fuel system. Combustion-wise, it is likely that high-melt fuels will have a low viscosity at the burner. In a good burner this will mean cleaner combustion. Depending on sulfur restrictions and availability of fuels, present burners may be able to handle low-sulfur fuels without equipment changes.

36 APTIC NUMBER 17051

Salo, Eric A.
VISIBLE EXHAUST FROM FUEL OILS. Hydrocarbon Process., 49(2):96-98, Feb. 1970. 1 ref. (Presented to the Air Pollution Control Association, New York, June 1969.)

One possible source of emissions opacity is from the formation of sulfur trioxide, which can form sulfuric acid aerosols on

cooling. Tests run with natural gas and controlled injection of sulfur trioxide established an approximate threshold of 20 parts per million of sulfur trioxide for visible sulfuric acid plumes. With the normal rate of conversion in power boilers of the sulfur dioxide formed from combustion of fuel sulfur into sulfur trioxide, the threshold fuel sulfur is about 2 1/2%. This sulfur product is processed from imported stock of unusual composition. Conspicuous to power plant operators is the high pour point which makes it necessary to design a fuel system for a minimum temperature of 130 F or more compared with the common 100 F minimum. Another possible source of emissions opacity is from the formation of sulfur trioxide, which can form sulfuric acid aerosols on cooling. Tests run with natural gas and controlled injection of sulfur trioxide established an approximate threshold of 20 parts per million of sulfur trioxide for visible sulfuric acid plumes. With the normal rate of conversion in power boilers of the sulfur dioxide formed from combustion of fuel sulfur into sulfur trioxide, the threshold fuel sulfur is about 2 1/2%. This supports the policy of specifying a maximum of fuel sulfur of two percent. The problems of conformance and of enforcement of the opacity regulations are due mainly to the fact that opacity is difficult to evaluate with portable instrumentation that inspectors could use.

37 APTIC NUMBER 17291

Saruta, Hanio, Noburu Ishinishi, Yasushi Kodama, Kizaburo Kunitake, Toshio Baba, and Yoko Katori
AIR POLLUTION CAUSED BY EXHAUST GASES FROM MOTOR VEHICLES IN BOTH KITAKYUSHU CITY AND JUKUOKA CITY (II). (Kogyotoshi to shogyotoshi ni okeru jidosha haikigasu ni yoru taiki osen no hikaku --- kitakyushushi oyobi fukuokasji ni okeru jittaichosa kara (II)). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4 (12):779-787, Dec. 15, 1968. 11 refs.

Two principal types of urban air pollution were recognized by a survey conducted in both industrial and business areas which contrasted each other with respect to social and economic structural differences. Stack smoke from industrial plants is an important constituent of urban air pollution. Concentrations of dust and sulfur dioxide are higher in industrial areas than carbon monoxide. Dust and SO2 concentrations in the proximity of the source decline in proportion to an increase of CO. This result is evidently identified with the transition of types from one to the other. Even lower concentrations of SO2 in industrial air pollution are dangerous when followed with dust. Separately their effects on human health are of less significance. Air pollution in the business area originates in automotive exhaust emissions which have a stimulating affect on the generation of lung cancer because of the lead compound contained in the gasoline. Dust from boiler heating forms an additional part of the urban industrial pollution. These major sources are regarded as factors in the occurrence of photochemical smog. Although two principle types of industrial and business air pollution varies in its source, both its effects on public health can not be graded but are similar in view of enviornmental hygienics.

38 APTIC NUMBER 17299

Saruta, Hanio, Noburu Ishinishi, Yasushi Kodama, Kizaburo Kunitake, Toshio Baba, and Yoko Katori
AIR POLLUTION CAUSED BY EXHAUSTED GASES FROM MOTOR VEHICLES IN BOTH KITAKYUSHU CITY AND FUKUOKA CITY. (I). (Kogyotoshi to shogyotoshi niokeru jidosha haikigasu niyoru taikiosen no hikaku - Kitakyushushi oyobi Fukuokashi niokeru jittai chosa kara (I)). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(11): 735-739, Nov. 15, 1968.

Kitakyushu City is one of the most polluted cities in Japan. Compared to the soot and smoke emitted by the iron works in Yahata Ward, air pollution by automotive exhaust gas is small, although the latter is becoming a serious public nuisance during rush hours when traffic comes to a standstill because of the number of vehicles on the highways and the number of traffic intersections . At present, air pollution control measures in Kitakyushu are directed mainly against the soot and smoke by factories and center on the Kitakyushu and Onuta industrial belts; automotive exhaust gas is not yet a matter of interest. Over a one year period, air quality measurements were made every other month at two sidewalk points along the highway in Yahata Ward and also at two sidewalk points near an intersection in the commercial city of Fukuoka. Seasonal changes in air pollution, differences in air pollution due to the social and economic characteristics of the cities, and the relation of air pollution due to factory soot and smoke to that due to automotive exhaust gas are being studied. Conclusions will be given in a forthcoming report.

39 APTIC NUMBER 16792

Shearer, S. D., Jr., and C. W. Sill
EVALUATION OF ATMOSPHERIC RADON IN THE VICINITY OF URANIUM MILL TAILINGS. Health Phys., 17(1):77-88, July 1969. 3 refs.

A field study is currently being concluded at Grand Junction and Durango, Colorado, and at Monticello and Salt Lake City, Utah, to evaluate the public health aspects of atmospheric 222Rn in the vicinity of uranium tailings piles. Air is collected continuously for 48 hr periods from each station in order to average out diurnal fluctuations. The integrated sample is then analyzed for 222Rn. A total of 57 stations is in operation. Each station is sampled every three weeks for one calendar year to include seasonal fluctuations and to permit a more realistic estimate of the yearly dose to people in the immediate vicinity. This paper presents data and conclusions from the 1 yr study. Of the 13 stations directly over tailings, average radon concentrations ranged from 3.5 pCi/l to 16 pCi/l. Of the 44 stations not over tailings, only two averaged greater than 1 pCi/l. The results indicate negligible radiation exposure of the surrounding population from this source. (Author's Abstract)

40 APTIC NUMBER 17184

Shirasawa, Tomiichiro
PUBLIC NUISANCE PREVENTION IN THERMAL POWER PLANTS. (Karyoku

hatsudenjo ni okeru kogai boshi taisaku). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 1(1):37-40, April 15, 1965.

Three aspects of pollution by thermal power plants are discussed: smoke emissions; the rise in ocean temperature together with the contamination of sea water by oil discharges and boiler waste water; and operating and construction noise. (1) The present emission standard for sulfur oxides (SO2 + SO3) in smoke dust is below 0.22 ppm in terms of capacity proportion; its dust component is below 1.2 g/cu m in case of thermal power plants. Between 10 and 20 g/cu m of dust is generally present in stack smoke from coal combustion prior to dust collection; this means that coal-fired thermal power plants need to have dust collectors with 90% collection efficiency to meet the smoke emission standard. About three percent sulfur-bearing heavy oil can meet the standard under proper combustion conditions. The boiler cleansing water discharge does not markedly affect ocean temperature, since its initial temperature declines sufficiently in passing through drain pipes before reaching the sewer outlet. In addition, the sewer outlet is of sufficient depth. The amount of chlorine used to protect drain pipes from an encroachment by shellfish is minimal and generally digested by organic components of the cleansing water. Other waste water (acid and alkaline), used for boiler tube washing is discharged after neutralization, settling, or filtering and can not be the reason for water pollution. Leakages of oily waste water occasionally occur during overall inspection of machines or other equipment, but drainage systems associated with an oil distributor tank should be able to collect the oil compounds. The major noise in thermal power plants originates in transformers and ventilators which can make around 100 phon inside a plant, but generally less, and perhaps 60 phon outside. In preparation for future plant expansions, many noise suppression devices will be considered.

41 APTIC NUMBER 17277

Spengler, Guenter and Gerhard Haupt
FORMATION OF SOOT AND POLYCYCLIC AROMATIC HYDROCARBONS IN SIMPLE HYDROCARBON FLAMES AND ITS INHIBITION BY FUEL ADDITIVES. (Russ- und Aromatenbildung in einfachen Kohlenwasserstoff-Flammen und ihre Beeinflussung durch Brennstoffzusaetze). Text in German. Erdoel Kohle (Hamburg), 22(11):679-684, Nov. 1969. 13 refs.

Diesel fuel DEF2405, n-hexane, cyclohexane, benzene, and decalin were burned in a burner in which the fuel from the surface of the liquid was burned with combustion air coming from the outside. The amounts of soot and of polycyclic aromatic hydrocarbons absorbed by the soot and in the gaseous combustion product was determined. The individual polycyclic aromatic hydrocarbons determined were: naphthalene, monomethylnaphthalene, dimethylnaphthalene, acenaphthalene, fluorene, anthracene, phenanthrene, pyrene, fluoranthene, chrysene, 1,2- and 3,4-benzopyrene, anthanthrene, 1,12-benzoperylene, and coronene. In a second series of tests, a 3:1 mixture of n-pentane and acetylene with different metal-bearing (or an organic) additives were atomized in the burner by a nozzle with the aid of nitrogen before coming into contact with the outside combustion air. The individual additives were: methylcyclopentadienyl manganese tricarbonyl, iron pentacarbonyl, iron dicyclopentadienyl ('Ferrocene'), as well as cyclohexanolnitrate. The percent decrease of the amount of soot and of the amount of polycyclic aromatic hydrocarbons adsorbed by it with increasing content of each of the three metal-bearing additives are given. The addition of cyclohexanolnitrate had no effect on the soot formation. A possible mechanism of soot formation and of the action of additives on it is represented schematically.

42 APTIC NUMBER 17175

Swinnerton, J. W., V. J. Linnenbom, and R. A. Lamontagne
THE OCEAN: A NATURAL SOURCE OF CARBON MONOXIDE. Science, 167 (3920):984-986, Feb. 1970. 9 refs.

The distribution of carbon monoxide between the atmosphere and surface waters of the ocean was investigated. Preliminary results indicated that the surface waters are supersaturated in carbon monoxide with respect to the partial pressure of the gas in the atmosphere. Two 24-hour stations were occupied at which both air and surface water samples were taken at 2-hour intervals. All samples were collected and analyzed within 1 hour of collection. The stations were located 64 km east of Barbados and 112 km east of Trinidad. Two characteristics were evident: the relatively constant concentration of CO in the atmosphere at both locations; and a marked diurnal effect with respect to concentration of CO in the surface waters. The source of the excess carbon monoxide found in the seawater is not known. The mechanism of production may be biological in nature or it may be possible that photochemical decomposition of organic matter near the surface is responsible. The supersaturation of the surface waters with respect to atmospheric partial pressures of CO indicates that the net transport of carbon monoxide across the air-sea interface should be from the water into the atmosphere. Although the absolute concentrations of dissolved CO are low on a world-wide basis, the amount of CO produced could be considerable. The amount represents about 5% of the estimated carbon monoxide produced by man, which makes the ocean by far the largest natural source of carbon monoxide known, if one assumes a world-wide production of carbon monoxide in the upper layers of the ocean similar to that found in the western Atlantic.

43 APTIC NUMBER 16828

Thomas, J. F., E. H. Jones, and D. L. Brink
A MECHANISM TO EXPLAIN THE PRODUCTION OF MALODOROUS PRODUCTS IN KRAFT RECOVERY FURNACES. Tappi, 52(10):1873-1875, Oct. 1969. 9 refs.

Some fundamentals of combustion which may offer an explanation for the origin of malodorous sulfur pollutants which originate in kraft recovery furnaces and which may indicate a method to control these malodors are reviewed. The combustion can be characterized by initial endothermic reactions, which degrade the organic part of the black liquor into smaller and smaller fragments, and by the competing exothermic reactions of oxidation and recombination. The recombination reactions are responsible for the formation of the malodorous compounds. It is suggested that by separating the oxidation reactions from the endothermic and recombination reactions, a furnace effluent could be produced which would be

completely odor free. (Author's Abstract)

44 APTIC NUMBER 17267

Ueda, Junichi
THE PRESENT CONDITION OF AIR POLLUTION CAUSED BY GAS OF AUTOMOBILES AND THE COUNTERMEASURES TO IT IN KYOTO CITY. (Bonchijo chiiki ni okeru jidosha haikigasu ni yoru taiki osen no genjo to sono taisaku). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(11):729-734, Nov. 15, 1968. 11 refs.

A great concern in Kyoto city is air pollution by motor vehicles, since there are many historical spots and cultural properities. It is characteristic of Kyoto city that not only motor vehicles but also a great number of sightseeing buses, are the major subject matter in disussing air pollution control. The annual increase in sightseeing bus traffic is 17.2% and during a special occasion, the carbon monoxide density was recorded as two times greater in a place which is almost equivalent to the total density of the whole city. The effect of exhaust emissions on temples and shrines is of significance in view of the protection and preservation of historical properties. Studies on the effect of exhaust emissions on silk thread, clothes, and silver leaf are being conducted with an alkali filter. Considering the effect on human health, historical properties and vegetation, a method for controlling CO exhaust emissions was undertaken. A motor vehicle which has passed idling inspection is given a sticker and a remarkable result was attained. The average CO density, 4.30% before the idling inspection was begun, showed a marked decrease. Several large scale progrmas to control air pollution by motor vehicles in Kyoto, including a plan to establish a more consolidated railroad system, a plan to consolidate the traffic system in the suburbs, and a plan of flexible adjustment for the large inflow of motor vehicles and buses into the city were presented.

45 APTIC NUMBER 17052

Viland, Clare Kenneth
AIR POLLUTION AND ATOMIC POWER. Mines Mag. (Denver), 60(1):17, 19-20, 22-23, Jan. 1970.

Some of the facts pertaining to generation of electrical power by nuclear (atomic) energy are presented. Since (1) nuclear power plants are incapable of producing an explosion and radioactive 'fallout', as with a bomb; (2) the reactor fuel, presently mostly 'enriched' natural uranium containing slightly more uranium 235 than found in nature, is completely encapsulated by suitable metals or alloys thereof; and (3) the reactors themselves are enclosed, and heavily shielded to stop gamma rays, which are essentially X-rays, emissions to the air or to cooling water are negligible. Radiation problems to workers are solved by proper use of shielding, observing proper distances, and time of exposure. Radioisotopes can be handled safely by anyone with proper training, facilities, and instrumentation. In the separate centrally-located nuclear fuel reprocessing plants, useful radioactive isotopes are recovered which are finding increasing use in research, medicine, and industry. Oil companies may use iron 59 to measure engine wear and thereby improve lubricating oils.

46 APTIC NUMBER 17028

Ware, G. W., E. J. Apple, W. P. Cahill, P. D. Gerhardt, and K. E. Frost
PESTICIDE DRIFT. II. MIST-BLOWER VS. AERIAL APPLICATION OF SPRAYS. J. Econ. Entomol., 62(4):844-846, Aug. 1969. 2 refs.

Downwind drift contamination of growing alfalfa and glass plates resulting from conventional airborne application of methoxychlor was compared with that resulting from ground application of the insecticide with a mist blower. Beneath target and at all distances downwind, the mist blower resulted in greater drift. Target alfalfa had 127 and 111 ppm insecticide; alfalfa 1/2 mile downwind had 0.27 and 0.14 ppm from the mist blower and plane, respectively. Glass-plate collections at 165, 330, 660, and 120 ft downwind were in agreement with alfalfa residues. Total airborne insecticide collected at 165 and 220 ft downwind in ethylene glycol air scrubbers from the mist blower was six times that of the aerial application. (Author abstract modified)

47 APTIC NUMBER 17248

Watanabe, Susumu, Yukihiro Mizukami, and Tsutomu Takuma
THE SITUATION AND CONTROL OF AUTOMOTIVE EXHAUST EMISSIONS IN SAPPORO CITY. (Kanreichi ni okeru jidosha haikigasu ni yoru taikiosen to sono taisaku). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(11):721-727, Nov. 15, 1968.

Data obtained by a survey of air pollution by motor vehicles in Sapporo city was analyzed. Automotive emissions are currently recognized in the city, where previously the major constituent of air pollution was smoke dust and dust fall from boilers and furnaces burning coal for heating. The recent air pollution did not appear to be consistent with smoke dust control acts with a main purpose of promoting the use of smokeless fuel and cokes instead of coal and controlling large boiler furnaces. The number of registered vehicles in 1967 doubled the amount in 1962 and fuel demand was about 4 times the amount in 1962. The amount of traffic at major intersections was estimated to be 15,000 to 35,000 vehicles, which shows an increase of 2.4 times that of five years ago. Roads are also poorly paved and traffic is delayed in winter due to heavy snow. The automotive exhaust emissions, carbon monoxide, sulfur dioxide, nitric oxide, nitrogen dioxide, and airborne dust do not indicate high densities despite the traffic increase; but at intersections in main streets, a high density was measured. The result of a control device tested on slow throttle timing of an engine system showed a decrease from 20% to 14% of CO exhaust emissions and in a secondary test, the figures decreased to 4.3% of average CO exhaust emissions. Countermeasures which are now planned to control automotive emissions involve composition of a Motor Vehicle Exhaust Control and a Noise Block Council, research on control devices appropriate for cold weather, and promotion of road heating to solve the traffic delay in the snow season.

48 APTIC NUMBER 11692

Wessler, Max Alden
MASS SPECTROGRAPHIC ANALYSIS OF EXHAUST PRODUCTS FROM AN AIR ASPIRATING DIESEL FUEL BURNER. Purdue Univ., Lafayette, Ind., Dept. of Mechanical Engineering, Thesis (Ph.D), Ann Arbor, Univ. Microfilms, Inc., 1968, 126p. 20 refs.

Samples of exhaust from a laboratory diesel-fuel spray burner operating on cetane and air, or cetane and an artificial air where argon replaced nitrogen, were condensed in a series of cold traps. The exhaust vapors were analyzed by a mass spectrometer as the traps warmed to room temperature. In some tests, the exhaust was bubbled through a five percent aqueous sodium bicaronate solution to trap acids from the sample before they entered the cold traps. The basic solution assumed a strong yellow color in the standard-air test but was milky in appearance in the argon-air test. No other significant differences between the results from tests with the two kinds of air were observed, either from the standpoint of odor or the mass spectra. The color of the bubbler solution is apparently the result of nitrogen compounds in the exhaust. The work demonstrates, however, that nitrogen compounds are not significant contributors to the diesel odor problem. Evidence is presented for the presence in the exhaust of longer series of alkenes and alkynes in addition to lower aldehydes, including acrolein and a series of alkadienes. Ethylene oxide, propylene oxide, and benzene are identified, and there is good evidence for alkadiynes, diethyl ether, and 1-buten-3-yne. The possibility of lower ketones, saturated and unsaturated cyclics, and heterocyclics is suggested. A group of peaks including mass-to-charge ratios 130,132, and 134 were present in all tests. No mass spectra data were found that would identify the compound that is the source for these peaks. (Author abstract modified)

49 APTIC NUMBER 17141

Akerlow, E. V.
DESIGN AND CONSTRUCTION OF FONTANA OPEN HEARTH PRECIPITATORS.
Iron Steel Engr., 34(6):131-138, June 1957.

Design modifications required to make an electrostatic precipitator suitable for collecting fumes from an open hearth furnace in a steel plant are discussed; as currently manufactured, precipitators are too light for open hearth service. Reinforcement of the precipitator and its supporting structure is necessary to minimize vibrations which can cause arcing and short the discharge and collecting electrical systems. Proper gas distribution within the precipitator is achieved by placing a distribution plate comprising three curved, perforated baskets across the width of the precipitator. It is also important that the arc in the precipitator be quickly quenched during high-grain loading conditions. A saturable reactor control with selenium rectifiers has many operating advantages, particularly in maintaining a higher rms voltage than conventional mechanical rectifiers. To eliminate dust buildup and reduce corrosion, rapping of the discharge electrode system is handled through outside rappers mounted on insulators which are in turn mounted in an air-cooled chamber. Problems of condensation inside the precipitator are corrected by the installation of ligh-weight insulating aggregate concrete on the preciptator roof.

50 APTIC NUMBER 15879

IMPROVEMENTS IN OR RELATING TO A PROCESS FOR RECOVERING SULPHUR DIOXIDE FROM A GAS MIXTURE CONTAINING THE SAME. (American Smelting and Refining Co., New York) British Pat. 564, 734. 5p., Oct. 11, 1944. (Appl. June 29, 1942, 16 claims).

In a cyclic process for recovering sulfur dioxide from smelter smoke, flue gases, etc., sulfur dioxide-containing gas is first absorbed in an aromatic amine reagent of the aniline class and its homologues and derivatives preferably dimethylaniline. The exit gases are then scrubbed with sodium carbonate and sulfuric acid solutions to remove the reagent, following which the resulting solutions are combined and heated by steam to release the sulfur dioxide and the regenerated amine esters. The released reagent is returned to absorb additional sulfur dioxide. While various types of scrubbers may be employed in the process, best results are obtained with bubble towers. Compared to other processes, the operation greatly reduces reagent losses and regenerative costs.

51 APTIC NUMBER 16785

Annis, Jason C., Verl E. Headley, and Sylvio L. Lima
EVALUATION OF THE LIQUID FAT INJECTION METHOD OF CONTROLLING ALFALFA DEHYDRATOR EFFLUENT. J. Air Pollution Control Assoc., 20(1):23-30, January 1970. 12 refs.

The use of liquid animal fat to reduce particulate effluent from cyclone collectors in alfalfa dehydrating plants has been tried in the past. However, no data of a controlled evaluation has been published. The difficulty of accurate particulate sampling at a cyclone discharge duct may be the reason. Working with a pilot feed mill, the investigators developed an accurate particulate sampling scheme, tested the effect of solid-air ratio and inlet velocity, and evaluated the fat injection method for reducing cyclone effluent. Accurate sampling required flow-straightening and velocity profile-flattening, without adding appreciable flow resistance. Fat was sprayed on the dried alfalfa prior to grinding. Particulate effluent at the cyclone following, normally 50-60% of the mill total, was reduced by 96.4 and 99.4% by adding 2 and 4% fat, respectively. The recovered product was 50% higher in protein than the normally collected product. The fat significantly retarded the deterioration loss of carotene (pro-vitamin A), being 20% less after 4 months' storage with 2% fat. Fat reduced the energy required for pelleting and increased the metabolizable energy. It produced no significant increase in rancidity, pellet fragileness or grinding energy requirements. At the 2% level of fat addition, the cost of the process operation ranges from nothing to $0.80/tn, depending on the usefulness of the carotene preservation factor. Installation and maintenance cost is much less than that of alternate methods for controlling cyclone effluent with alfalfa dehydrators. (Author's Abstract)

52 APTIC NUMBER 17234

Arai, Kenya
AIR POLLUTION SOURCES AND THEIR CONTROL IN THE IRON AND STEEL INDUSTRY - COUNTERMEASURES FOR SMOKES FROM BLAST, MELTING, AND HEATING FURNACES. (Tekko gyo ni okeru baien shori gijutsu - Koro, yosenro, kinzuku kanetsuro nado no baien taisaku). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(6):379-383, July 15, 1966.

The law of smoke control establishes smoke discharge standards for all establishments generating smoke. No establishment can discharge more smoke than the standard for its category. The standard for a blast furnace is 0.5 g per N cu m; a cupola, 2.0; a metal heating furnace, 0.7; and a drying furnace, 1.2. The law also establishes sulfur dioxide and sulfur trioxide discharge standards. When their concentrations exceed 0.5 ppm, cooperation of the industry is demanded. A blast furnace usually discharges about two thousand N cu m per ton of pig iron, making it a large smog source. The exhaust gas from a blast furnace contains from 5 to 10 grams per N cu m of smog. A primary dust collector lowers the quantity to below 5 gram per N cu m while a secondary dust collector lowers it to below 0.01 gram per N cu m. The primary dust collector utilizes inertial force. Secondary dust collecting methods are classified as dry or wet. The dry method uses electrical dust collectors; the wet method uses mechanical or electrical dust collectors after washing by cleaning columns or venturi scrubbers. Control methods for the smoke of other furnaces are also reviewed. Desulfurization methods are divided into wet and the dry methods. The wet methods involve washing by alkali or amine solutions. Their merits are low costs and high efficiencies; their disadvantages are the lowering of gas temperature. Dry methods are those involving absorption of adsorption by solids.

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53 APTIC NUMBER 17067

Ariyoshi, Tsuyoshi
DISPOSAL OF HYDROGEN SULFIDE AND SULFUR RECOVERY IN PETROLEUM REFINERY. (Sekiyu seisei kojyo ni okeru ryuka suiso no jogai to ion kaishu no jissai rei). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(7):467-472, Aug. 15, 1966.

Most of the crude oil imported by Japan is from the Middle East and contains 1.5 to 3% sulfur. As an example, purification of a crude oil yielded the following results: volatile oil, 0.05% sulfur; kerosine, 0.15%; light oil, 0.45%; number 1 A heavy oil, 0.3%; B heavy oil, 2.1%; number 1 C heavy oil, 0.95%; and number 4 C heavy oil, 3.0%. Sulfur compounds contained in crude oil are mercaptans, aliphatic sulfurs, bisulfur compounds, thiophene, and so on. Hydrogen sulfide is not an important component, but sulfur compounds change to hydrogen sulfide by decomposition or hydrogenation in the course of purification. Hydrogen sulfide is removed by absorption by alkanolamines such as monoethnolamine, diethanolamine, triethanolamine, methyl triethanolamine, and diisopropanolamine. Hydrogen sulfide absorbed by an amine is stripped by hot steam. Sulfur is obtained by partial combustion of the hydrogen sulfide. One-third of the hydrogen sulfide is burned and converted to sulfur dioxide which reacts with the remaining two-thirds to generate sulfur.

54 APTIC NUMBER 17151

Basse, Bernard
GASES CLEANED BY THE USE OF SCRUBBERS. Blast Furn. Steel Plant, 44(11):1307-1312, Nov. 1956. 10 refs.

Venturi scrubbers can successfully handle large volumes of the submicron fumes generated in steel and blast furnace processes. The most practical application of the scrubber is in cleaning blast furnace gas. Furnace top pressure is utilized to provide power for scrubbing: except for the small pumping requirement of 4-8 gallons per 100 cfm at 90 psig, no outside source of power is required. In most furnaces with top pressures of 60-75 in wg, the venturi pressure drop runs 28-35 in wg. These reduce dust loadings in the cleaned gas to 0.01 to 0.05 grain per Scf. A pilot study carried out with a 10,000 cfm venturi unit indicates a 0.0019 grain per Scf loading at a pressure drop of 83.5 in wg. Venturi scrubbers also reduce fumes emitted by oxygen converter processes to a point where they become completely invisible. Dust loadings in the gases are reduced from 8 gr/Scf of iron oxide and graphite particles to between 0.03 and .90 gr/Scf. When operated at 14 in wg, the scrubbers remove over 98% of the fume from oxygen-lanced open hearth furnaces and reduce the dust load in the gas to less than 0.04 gr/Scf. For air pollution applications, the power required by venturi scrubbers can be adjusted to meet nearly all local ordinances and visibility requirements.

55 APTIC NUMBER 16933

Benny, J. C.
SULPHUR DIOXIDE RECOVERY. Pulp Paper Mag. Can. (Quebec), vol. 46:598, 1945.

A sulfur dioxide recovery system consisting of two absorption towers is described. The first tower, called the recovery tower, is a wooden construction 26 ft high and seven ft in diameter, and is packed with 3 tiers 3-1/4 inch spiral tile. All unabsorbed gases leave the top of the recovery tower and enter the bottom of the second tower, called the tail gas tower. The resulting fortified raw acid is pumped to the mixing tank. The tail gas tower is 21 ft high, constructed of glazed sewer tile three ft in diameter. It is filled with one inch Raschig rings, except the bottom two ft, where 3 tiers 2-1/4 inch spiral tile are packed. All gases leaving the recovery tower enter this tower at the bottom and the SO2 is absorbed by fresh water flowing down over the tile. The acidified water, collected in a tank beneath the tower, is pumped to the medium tower of the acid plant. The benefits realized from this installation are: (1) over 20% increase in cooking acid strength; (2) tailings have been reduced 35%, and No. 1 pulp produced has been increased about three percent; (3) the accumulator temperatures has been raised five degrees; (4) there has been an improvement in pulp quality; and (5) acid plant operation is more uniform, the variation in raw acid strength being reduced 50%.

56 APTIC NUMBER 17074

Benarie, Michael
INFLUENCE OF PORE STRUCTURE UPON SEPARATION EFFICIENCY IN FIBER FILTERS. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(2):37-42, Feb. 1969. 26 refs.

Because porosity of fiber filters is a mean value subject to considerable local variations, it must be described as a function of pore size distribution. A theoretical investigation of the distribution function of pores in a natural logarithmic scale shows that it can usually be expressed by a straight line. From this distribution, the flow distribution is obtained in a very simple way. In many fiber filters, however, the largest portion of flow passes through a small number of large pores. Therefore, the efficiency of the filter depends to a large extent on pore structure and can be calculated from it. If the structure is uniform with the logarithmic standard deviation for distribution almost zero, the calculation gives values in good agreement with practical experience. In the case of a logarithmic standard deviation of 5-6, there is no filtration because almost everything passes through. (Author summary modified)

57 APTIC NUMBER 17140

Berg, Bengt
DEVELOPMENT OF A NEW HORIZONTAL-FLOW, PLATE-TYPE PRECIPITATOR FOR BLAST FURNACE GAS CLEANING. Iron Steel Engr., 36(10):93-101, Oct. 1959. 3 refs.

A discussion of the general relationship between precipitator size and collection efficiency is followed by a review of the development of a horizontal-flow precipitator which is expected to be less expensive and less complicated than a verticle-flow precipitator. The precipitator comprises two or more independent

zones built into one chamber, with collecting electrodes of plane steel plates forming one zone. Selenium rectifiers provide saturable reactor control. The electrodes are cleaned by water flushing; a mist of water droplets is introduced from spray nozzles placed on top of each precipitator section as well as in front of the precipitator. This flushing method eliminates size and height restrictions for wet precipitators. Collection efficiencies above 99% are easily obtained and dust concentrations in the clean gas have reached 0.0004 grain per cu ft. Efficiency is not lowered during the flushing periods.

58 APTIC NUMBER 17133

Bienstock, D., J. H. Field, and J. G. Myers
REMOVAL OF SULFUR OXIDES FROM FLUE GAS WITH ALKALIZED ALUMINA AT ELEVATED TEMPERATURES. J. Eng. Power, vol. 86:353-360, July 1964. 11 refs. (Presented at the ASME - AIEE National Power Conference, Cincinnati, Ohio, Sept. 22-25, 1963, Paper 63-Pwr-14.)

A cyclic process is described for removing the oxides of sulfur from flue gas by absorption at 625 F and then converting the oxides to elemental sulfur by reduction of the spent absorbent. Pilot-plant experiments are reported in which a solid absorbent of alkalized alumina in free and baffled fall is used to remove SO2 and SO3 from the combustion gas of a pulverized-coal-fired furnace. The absorbent is then regenerated by heating with hydrogen or with steam-reformed natural gas. Flyash does not interfere and attrition is negligible. (Author abstract modified)

59 APTIC NUMBER 16991

Biryukova, L. V., V. G. Ovcharenko, A. M. Mironov, and A. A. Karabayev
TEST OF ATOMIZERS AND SPRINKLING DEVICES USED FOR SPRAYING IN ABSORBERS. (Ispytaniye forsunok i razbryzgivayushchikh ustroystv, primenyayemykh dlya orosheniya v absorberakh). Text in Russian. Khim. Prom. (Moscow), no. 6:64-68, 1963. 1 ref.

The gas-absorption effectiveness of scrubbers, depends on the uniformity of the distribution of the atomized liquid over the cross-sectional area of the column. To obtain information regarding the performance of six existing designs of spray nozzles, the spray patterns were determined of a total of 12 modifications of these designs in a total of 26 tests at water pressures between 0.2 and 2.0 atm and distances between 0.90 and 2.20 m from the nozzle. On a horizontal 9-m-diameter platform, jars of 500-ml capacity each were placed on 20-cm centers, as defined by a grid of fastened laths. The nozzle to be tested was attached, facing vertically down, to the upper end of a supporting water pipe which rose from the platform center and was provided with a manometer placed just upstream of the nozzle, a fast-acting water valve and a water meter. In a test at the desired height above the platform, the desired pressure was pre-set and the valve to the nozzle opened, starting a stop watch. The spray from the nozzle continued until the valve was closed, stopping the stop watch as soon as some one or several jars were filled to capacity. After reading the water meter, the amount of water collected in each jar was measured and recorded on a map showing the jar positions from which a five-level spray-density distribution pattern of the nozzle in the test was prepared. The water meter and stop watch readings yielded the rate of flow, in cu m/hr of water through the nozzle. The ratio of this and the effective wetted area, in sq m, of that pattern gave the average wetting rate in that area, in cu m/sq m hr. The test results are compiled and nine typical spray patterns are shown giving the nozzle modification and water pressure used in the test as well as the radius, of the effective wetted area. The nozzles are evaluated with respect to their throughput capacity, in cu m/hr, and the degree of uniformity of their spray patterns.

60 APTIC NUMBER 17154

Bishop, C. A., W. W. Campbell, D. L. Hunter, and H. W. Lightner
SUCCESSFUL CLEANING OF OPEN-HEARTH EXHAUST GAS WITH A HIGH-ENERGY VENTURI SCRUBBER. J. Air Pollution Control Assoc., 11(2):83-87, Feb. 1961. (Presented at the Annual Meeting of the Air Pollution Control Association, 53rd, Cincinnati, Ohio, May 22-26, 1960.)

The operation and performance of a venturi scrubber system installed in a full-scale open-hearth process in a steel plant was evaluated. The open-hearth process was briefly described. Because of considerable variability in the properties of the stack gases and dust from the open-hearth process, it was difficult to obtain the desired high level of performance from the gas cleaning equipment. The venturi scrubber consists essentially of a gas restriction and a water-spray system at the restriction. The turbulence created by the gas passing through the restriction atomizes the water and permits intimate contact between the water droplets and the solid dust particles in the gas stream. The wetted particles are then removed from the gas stream as the gas passes into an inertial type entrainment separator. The results of the test indicated that when operating at a pressure drop of 30 in. of water, a venturi scrubber will satisfactorilly clean open-hearth gas to 0.05 grain per standard cu ft, and there will be little or no visible effluent in the exhaust gas other than the steam plume. Satisfactory operation of the recycle scrubbing-water system was achieved by bleeding 5% of the total scrubbing water, containing about 1.5% solids by weight, to a settling basin. The test program also provided sufficient operating-cost and design information to indicate that the investment and operating costs of a venturi-scrubber system would compete very favorably with those of a precipitator-waste-heat boiler system for cleaning the gas from open-hearth shops that have an anticipated operating life of no more than a few years. An economical and efficient method for cleaning the gas from those shops that have an operating life of longer than a few years is still sought.

61 APTIC NUMBER 11693

Black, Charles Hartgraves
EFFECTIVENESS OF A FLUIDIZED BED IN FILTRATION OF AIRBORNE PARTICULATE OF SUBMICRON SIZE. Oregon State Univ., Corvallis, Dept. of Mechanical Engineering, Thesis (Ph.D), Ann Arbor, Univ. Microfilms, Inc., 1967, 80p. 22 refs.

The effectiveness of a fluidized bed in removing airborne

particulates from an air stream was investigated at superficial gas velocities of 8.75-25.0 ft/min. Bed height-to-diameter ratios were varied from two to six. Concentrations of aerosol were 0.03-8.3 milligrams/cu m. Ambient temperatures prevailed, normally 20-30 C. Fluid bed performance was studied as a function of bed height, gas flow rates, aerosol concentration, and size distribution. Filtration efficiencies for either submicron ammonium chloride or tobacco particles ranged from 50-90% on a count basis. Lowest efficiencies were encountered at highest gas flow rates and lowest bed heights. Highest efficiencies resulted from low gas flow rates and high bed heights. No effective change in filtration efficiencies were found as a result of bed age or changes in challenging aerosol concentration. An equation was derived which fits all test data within experimental accuracies. Pertinent theoretical target efficiencies were also evaluated to determine the major filtration mechanism. Strong target efficiencies were indicated only for the interceptive mechanism. However, as this mechanism is independent of velocity, and efficiencies in the study show a slight velocity effect, other filtration mechanisms are also considered to be operative.

62 APTIC NUMBER 16910

Bloha, C. L.
PROCESSING SULFUR BEARING GASES. Petrol. Eng., vol. 24:C-68-C-74, April 1952. 20 refs. (Presented at the Natural Gasoline Association of America, Regional Meeting, Odessa, Texas, Feb. 29, 1952.)

Several sulfur conversion processes are reviewed, including the organic amine regenerative process. Theoretical equilibrium conversion and dew point curves and a schematics of a plant layout with flow diagrams are given. The maximum theoretical conversion attainable in commercial practice is about 93%. Investment and operating costs for sulfur plants of various capacities are plotted. The present price of crude bulk sulfur is discussed. Increasing industrial use of sulfur recovery processes is indicative of its econo ical feasibility.

63 APTIC NUMBER 16783

Bluse, J. E., D. E. Miller, and L. A. Nicolai
REMOVE SULFUR FROM FUEL OIL AT LOWEST COST. Hydrocarbon Process., 48(9):131-136, Sept. 1969.

The relative advantages, limitations, and costs are explored for several hydrodesulfurization routes to low-sulfur fuel oils. These routes are: Hydrodesulfurization of atmospheric residuum, hydrodesulfurization of vacuum gas oil (VGO), and hydrodesulfurization of vacuum gas oil coupled with hydrodesulfurization of the deasphalted vacuum bottoms (VGO/DAO). Since the three processes achieve different levels of desulfurization, the choice of process must depend on both economics and product sulfur requirements. Residuum hydrodesulfurization can produce a fuel oil with 1.1 wt.% sulfur at $0.70/bbl; the VGO process produces 3.1 wt% sulfur product at $0.26/bbl and VGO/DAO produces 2.4 wt% sulfur product at $0.50/bbl. Comparing the process alternatives on a fixed product sulfur level the cost per barrel of 3.1 wt% sulfur fuel oil is $0.30/bbl by residuum hydrodesulfurization and $0.26/bbl by VGO process. The cost per barrel for 2.4 wt% sulfur product is $0.45/bbl by residuum hydrodesulfurization and $0.50/bbl by VGO/DAO process.

64 APTIC NUMBER 16652

Bronan, Carl U. and Ronald E. Iseli
THE CONTROL OF OPEN HEARTH STACK EMISSIONS WITH VENTURI TYPE SCRUBBERS. Ind. Heating, 35(6):1085-6, 1088, 1090, 1092, 1094, 1096, June 1968. II PART. Ibid. vol. 35:1985, 1486, 1488, 1490, Aug. 1968. 6 refs. (Presented at the American Iron and Steel Inst. Technical Meeting, Chicago, 1967.)

Designing a scrubber gas cleaning system to control open hearth fume emissions, isokinetic sampling of the stack gases was carried out to determine dust loadings and particle size and composition; average stack gas dust loadings are shown in Part I for various periods of open hearth heats. The operation of the venturi scrubber, its location, and its design features are described in detail, with diagrams given of the waste heat boiler draft control system, the equipment location and the gas flow and slurry systems. The throat section of the scrubber initially installed was designed to handle a maximum flow of 70,000 scfm of dry gas at temperatures of 600 to 1500 C. The equipment specifically called for minimum pressure drop of 30 in. of water across the venturi in order to obtain the required cleaning efficiency. The induced draft fan constructed had a rating of 93,000 cfm at 41 in. suction. Part II discusses the operating and maintenance problems experienced with the gas flow and water slurry systems. The major problem with the gas flow system, the near-collapse of the spin vane section in the cooling tower, was taken as proof that the common cooling tower built for two gas flow systems was a mistake. The many problems incurred with the slurry system were attributed in part to confining all the equipment within the lean-to area. Discoloration of the sewer water from the red iron oxide also occurred. Design corrections were made for later installations of scrubbers on other furnaces in the same shop. Gas cleaning has been excellent with greater than 99% efficiency and less than .05 grains per standard cubic foot dust loading in the exhaust gases. The scrubbers have not hampered the operations of the furnaces and may have contributed to improved performance; in addition, the source of constant draft from the scrubber induced draft fan was found to benefit furnace operation.

65 APTIC NUMBER 15651

Carr, John
PURIFICATION METHOD OF EXHAUST GAS. (Haigasu seisei hoho). Text in Japanese. (Peter Spence and Sons Ltd., Widnes, England) Japanese Pat. Sho 44-14686. 5p., June 30, 1969. (Appl. April 7, 1966, claims not given).

The cost of separating and lowering the sulfur dioxide content of flue gas should be kept within certain limits, and a sufficient market should be available for the by-products which are easily stocked and inexpensively transported. Sulfur is far more profitable than sulfuric acid from this standpoint. It is also

desirable not to use excessive electric power for pressing purposes, not to use excessive fuel for heating purposes, and not to lose buoyancy by cooling the flue gas. The present invention is a method of producing sulfur by reducing sulfur dioxide in the exhaust gas as well as reducing the catalyst used. A mixture of carbonyl sulfide and hydrogen sulfide was used as a reducing agent and was obtained by reacting sulfur with a mixture of carbon monoxide and hydrogen gas, made from hydrocarbon and steam. Using a quantity of reducing gas that is 50 to 90% of the theoretical quantity prevents hydrogen sulfide from reaching the chimney. Although the above reaction takes place at 50 to 300 C, it is favorable to limit it to 100 - 150 C. When regenerating the catalyst, carbonyl sulfide and hydrogen sulfide are simultaneously generated. Sulfur, liberated from the exhaust gas, adheres to the large area of the catalyst, and a part of it generates a reducing agent when the hot gas mixture of hydrogen and carbon dioxide is processed. Extra sulfur evaporates and is removed. Bauxite, activated alumina, activated titanium, a mixture of iron and aluminum oxide, zeolite, fire brick, and so forth can be used as catalysts. The harmful steam in the mixture of carbon monoxide and hydrogen gas reacts with carbon monoxide and generates hydrogen gas by using activated alumina.

66 APTIC NUMBER 15650

Case, Carl D., Daniel L. Bear, and Tunis Shrewders
PURIFICATION METHOD OF GAS CONTAINING NITROGEN OXIDES. (Chisso sankabutsu o ganyu suru gasu no seiseiho). Text in Japanese. (Engelhard Industries, Inc., Newark, N. J.) Japanese Pat. Sho 44-13002, 13 p., June 11, 1969. 3 refs. (Appl. March 18, 1965, claims not given).

In the production of nitric acid, harmful gases such as nitric oxide or nitrogen dioxide are produced. To prevent air pollution, nitrogen oxides must be eliminated completely from the final product. One way of eliminating the gases is by catalytic reduction, using reducing agents such as hydrogen, carbon monoxide, and so forth. In this invention, excessive back pressure, occurring in the conventional process using granular catalysts, and wear loss of expensive platinum metal catalysts are reduced to a minimum. The catalyst consists of a ceramic having more than one ditch for gas flow extending along the flow direction. The ceramic has pore diameters of 2000 A and is supported on outer surfaces opening into the ditches. Refractory metal oxide which has a surface area of at least 25 sq m/g precipitates on the ditches and also on the outer surfaces. Platinum metals precipitate on the refractory metal oxide. Several practical examples are shown for the terminal gas containing 0.9% nitric oxides. The nitric oxide content was lowered to 1 ppm. Pressure decrease was 0.508 (1.52) atm under 40,000 Vg/Vc/hr, 0.762 (5.33) under 10,000 Vg/Vc/hr, and 1.52 (14.2) Vg/Vc/hr, where Vg/Vc/hr means volume of gas per catalyst volume per hour. The values in parentheses are for a catalyst having a diameter of 0.635 cm.

67 APTIC NUMBER 17031

FLEET OPERATORS TURN TO NATURAL GAS. Chem. Eng. News, 48(7): 48-49, Feb. 16, 1970.

The conversion of federal and California state auto and truck fleets to natural gas is reported. In most cases, the converted cars will run on compressed natural gas following the installation of a dual-fuel system. A smaller number of vehicles will operate on liquefied natural gas. The cost of the dual-fuel system is about $300, plus about $50 per cylinder. Conversion from gasoline to natural gas is accomplished by a choke-like switch on the dashboard. The compressed gas is kept at about 2000 psu in a conventional 260-cu ft cylinder in a car's trunk or behind the cab of a truck. Two pressure regulators reduce the gas pressure before it enters a gas-air mixer mounted above a normal carburetor. Since a car or truck carries only one cyclinder, the range of the vehicle is limited to 40 or 50 miles. In contrast, the use of liquefied natural gas gives a range of 250 to 300 miles. However, there are only 14 natural gas liquefication plants in the country, so its wide distribution is not foreseen. Cost of the liquefied natural gas system is about $800 per conversion, with a double-walled insulating tank accounting for half the total. Emission tests with vehicles using natural gas offer the hope that the most stringent standards can be met. In California, 13 vehicles with the dual-fuel system gave average emissions of 2.1 grams of hydrocarbons, 7.5 grams of carbon monoxide, and 1.9 grams of nitrogen oxides per mile.

68 APTIC NUMBER 16747

Clement, J. L. and J. S. Elliot
NEW KRAFT RECOVERY BOILER DESIGN ELIMINATES UNPLEASANT ODOR. Paper Trade J., 153(16):63-65, April 21, 1969. 5 refs.

The use of multiple effect evaporators in place of direct-contact evaporators in kraft recovery boilers results in the elimination of most of the unpleasant odors associated with this process. In this new boiler design, unoxidized black liquor supplied directly from the multiple effect evaporator to the furnace is burned with complete combustion of malodorous compounds. A large bare tube economizer to cool combustion gases to a final stack temperature of 350 to 400 F is incorporated into the new design. Increased SO2 emission and changes in electrostatic precipitator operation are among the effects of the new design that are discussed. Well accepted in the Scandinavian countries, the new system is just being introduced into the U. S.

69 APTIC NUMBER 16926

Collin, F. C.
PURIFICATION OF METALLURGICAL GASES AND RECOVERY OF SULFUR DIOXIDE. 2. PROCESSING OF SULFUR DIOXIDE OBTAINED BY ABSORPTION. (Rensing av metallurgiske gasser og gjenvinning av svoveldioksyd). Text in Norwegian. Tidsskr. Kjemi Bergvesen Met., no. 7:112-117, 1941. 2 refs. PART I. Ibid, no. 9, Nov. 1940.

In 1934, the patented Sulfidin process made use of aromatic amines, toluidines, and xylidines as absorption media. A process was invented in 1935 using aluminum sulfate, first put into operation at the Outokumpu Copper Plant in Imatra, Finland. A Norway nickel plant, using dimethyaniline, was producing 12 tons

of sulfur dioxide per day by 1938. Aluminum sulfate and ammonium sulfite processes require aqueous solutions of these substances and a buffer to keep the pH at about 3.5-4.5. Below this figure, the solution becomes too acid to absorb additional SO2; above it, the process becomes irreversible, so that the SO2 cannot be recovered. When an aromatic absorber is used, aromatic and water are present in 2 phases. Initially, the hydrocarbon is lighter than water and stays on top; but as it absorbs SO2, its specific gravity increases and it sinks into the water to form a homogeneous solution which, when heated to 80-100 C, gives off enough SO2 to let the liquids separate into 2 phases. Aromatic amines have an essentially higher absorption capacity than aqueous aluminum sulfate. Xylidine gives best results when the SO2 content of the gas phase is low, whereas dimethylaniline performs best with high SO2 concentrations. Liquid sulfur dioxide was used (1941) by a number of Scandinavian paper mills in the pulpmaking process.

70 APTIC NUMBER 17053

Connor, John M.
NEW METHOD REDUCE AIR POLLUTION IN OLDER SULFURIC ACID PLANTS. Water Sewage Works, 117(1):IW/16-IW/19, Jan.-Feb. 1970.

There are a large number of plants in operation and in good shape, producing large quantities of acid, which were not designed according to current conversion standards and which cannot, without modification, meet the proposed new air pollution standards. Many of the smaller plants will probably be shut down, but the larger plants in good condition can be modified. Two schemes are offered for removing the sulfur dioxide from sulfuric acid plant stacks. Flow charts are given. A modified version of the first scheme could be designed to suit roaster gas plants in some cases, but the problem in connection with these plants is much more complex and each plant would have to be considered individually. The second scheme is simpler to install in an existing plant, and can potentially increase the total output of the plant by 10 to 20% and improve conversion at the same time. By taking advantage of the fact that the double absorption process is usually operated with 10% SO2 in the converter feed, compared to 8% in the standard plant, scheme 2 could be used to increase production by as much as 35%.

71 APTIC NUMBER 17138

Coulter, R. S.
SMOKE, DUST, FUMES CLOSELY CONTROLLED IN ELECTRIC FURNACES. Iron Age, 173(2):107-110, Jan. 14, 1954.

Smoke and fume emissions from three electric furnaces used to make plain carbon and low alloy steels in a single-slag process are successfully controlled by Cottrell type electrical precipitation equipment. Gas and dusts originating in the furnaces are drawn off through a water-cooled vent elbow, one end of which coincides with an opening in the furnace roof. The gases are then drawn through a two-pass flame trap, individual duct and louvre damper, a series of spray towers, and a motor-driven fan which pushes the gas and dust into the single two-unit precipitator serving all three furnaces. Acceptable precipitator efficiencies are achieved at a gas temperature below 127 F and 49% relative humidity. At full capacity, the fan handles 140,000 cfm of moistened dust-laden gases. The precipitated dust is accumulated in hoppers which are emptied by interconnecting screw conveyors. These lead to a drop pipe that discharges into a collection tank. From 12,000 to 20,000 pounds of dust are collected daily. No visible fume or dust issues from any furnace openings or roofs, even with power on and slag doors open.

72 APTIC NUMBER 17259

Danielevich, Yu. I. and Yu. K. Tupitsin
REMOVAL OF TOXIC IMPURITIES FROM GASES. Coke Chem. (USSR) (English translation from Russian of: Koks i Khim), vol. 6:45-46, 1969.

A technique and equipment for the removal of toxic organic impurities from waste gases minimized the fuel consumption needed to purify waste gases with a limited content of combustible substances by oxidizing decomposition products to carbon dioxide and water by using O2 in waste gases. The equipment included a vortex burner, a conical embrasure, and a cyclone firebox which is an internally lined metal casing preferably oblong, 2.5-4.0 m in length. The combined volume of gases was 110,000 cu m/hr. The actual gas consumption was 1 cu m per 60-90 cu m of waste gases. The limiting thermal load was 6,000,000 kcal/hr sq m cros section. The unit was air tight. The equipment operates under pressure and the final products can be used as heating gases. An experimental technique involved the removal of toxic impurities from waste air containing 7-11% O2 and 2.7% CO2 from fatty acid production. Thirty to forty percent of the waste air was admitted via the burner, the remainder being directed into the cyclone firebox. In the firebox, combustion products were mixed with cold waste gases producing a mixture temperature regulated by flow rates of the gases passing through the burner.

73 APTIC NUMBER 17011

DeHaven, Daniel L. and Allan B. Platt
SYSTEM STUDY OF EMISSION CONTROL FOR PASSENGER CARS. Inst. of Electrical and Electronics Engineers, New York, IEEE (Inst. Elec. Electron. Engrs.) Systems Science and Cybernetics Conf. Rec., San Francisco, Calif., 1968, p. 98-107. 21 refs. (Oct. 14-16.)

The paper contains two major problem elements: (1) determining the performance properties of the emission control device reflecting the vehicle population and driving mission; and (2) establishing the cost and benefit relations which accrue as a consequence of installing, inspecting, and maintaining the particular control device. The object is to prove the feasibility of determining the relative effectiveness of various means for controlling the effluent from automobile engines by studying a single control system as an example. The control system chosen is a bootstrapping direct-flame afterburner. The objective is composed of two parts: (1) the cost to society resulting from the addition of a maintained control system to the vehicle population; and (2) the benefit derived from the reduction of automotive effluents in the urban environment. The objectives are extremized by the best choice of four independent variables associated with the control system design. The

optimization is constrained by practical operating conditions of the afterburner and by maximum emission specifications on automotive effluents proposed by the National Air Pollution Center and in practice in the state of California. It is concluded that simulation and optimization studies should be completed for the most attractive emission control subsystems identified by the preliminary feasibility screening process.

74 APTIC NUMBER 16949

Dept. of Interior, Washington, D. C., Office of Coal Research
OFFICE OF COAL RESEARCH ANNUAL REPORT 1968. 56p., 1968.

This report of OCR activities for calendar year 1967 gives detailed attention to the pilot plant program and to anti-pollution benefits expected to result from the projects under development. The following pilot plants are described: a flyash brick plant for determining the commercial possibilities of flyash-based structural materials; (2) a plant for using pulverized coal to remove solids and dissolved organic substances from sewage and industrial waste waters; (3) a program to develop coal-fired boilers which use the fluidized-bed combustion process; and (4) a pilot plant for converting coal to gasoline. Various electric power projects are underway to develop a coal-energized fuel cell, a coal-fired electrogasdynamic generator, a coal-fired thermionic topper, and a coal-fired magnetohydrodynamic generator. All have the potential of achieving overall thermal efficiences of 55-60% or more, which would greatly reduce emissions of combustion products, and some of the systems have other beneficial anti-pollution features as well. The group of projects for developing practical methods of converting coal to pipeline-quality gas and synthetic petroleum would produce a coal-based fuel able to meet the most stringent air-pollution regulation, since the products must meet the same specifications as natural gas and petroleum for catalytic processing, and would thus have a negligible sulfur content. A number of OCR projects underway or planned are directed toward sulfur removal: the fluidized-bed combustion boiler program, the low-ash coal project, one of the liquid-fuel projects in which sulfur can be removed and recovered from char, and a program to produce low-sulfur boiler fuel using the Consol CO2 Acceptor Process. These are described briefly in terms of their implications for pollution control.

75 APTIC NUMBER 16972

Douglas, H. E., I. W. A. Snider, and G. H. Tomlinson, II
PROGRESS REPORT ON THE USE OF THE TURBULENT CONTACT ABSORBER FOR THE PREPARATION OF MAGNEFITE COOKING LIQUOR. Pulp Paper Mag. Can. (Quebec), 66(6):T-316 to T-318, June 1965. 1 ref. (Presented at the First International Sulphite Pulping Conference, Technical Section of the Canadian Pulp and Paper Association and the Technical Association of the Pulp and Paper Industry, Chicago, June 16-18, 1964.)

Conventional techniques for preparing magnesium bisulfite solutions by contacting a magnesium hydroxide solution with a sulfur dioxide-containing gas involve controlled multipoint addition of magnesium hydroxide and/or very high recycling rates to prevent the precipitation and settling of the intermediate product, magnesium hydroxide. By permitting single-point additions, the Turbulent Contact Absorber simplifies the control and operation of the absorption system, while reducing the absorption volume requirement. The absorber is characterized by an essentially nonflooding packing consisting of hollow plastic spheres placed between grids sufficiently far apart to permit a turbulent and random motion of the spheres, resulting from high gas and liquid velocities. The turbulence contributes to the intimate contact between gas and liquid phases at high flow rates, resulting in a high degree of mass transfer and allowing the use of towers having a fraction of the volume of those using static packing. Maximum capacity and efficiency of the absorption system is achieved at gas flows of 800-1200 fpm and a product liquor temperature of 150-160 F. The high-temperature operation contributes to the reduction of the heat requirements for digestion by a direct recovery of the heat of reaction involved in the conversion of Mg(OH)2 and SO2 to Mg(HSO3)2 and also of a major portion of the heat released in the combustion of sulfur. At high operating temperatures, the SO2 concentrations of inlet and outlet gases are about 17.5% and 0%, respectively.

76 APTIC NUMBER 16728

Durrant, T., S. C. Fiorello, J. J. Faitani, Seymour Hochheiser, and Elroy E. Lozano
COMBUSTOR DESIGN CHANGES REDUCE SMOKE FROM GAS TURBINE ENGINES. S.A.E. (Soc. Automot. Engrs.) J., 77(6):61-64, June 1969. 5 refs.

Smoke, the major pollutant produced by aircraft gas turbines, is of increasing concern to engine designers. Combustor design changes, which lean out local fuel rich pockets in the mixture, are the most promising means of decreasing smoke. Other research may prove that effective, economic, and immediate smoke reduction is possible by use of alternate fuels and fuel additives. An interesting comparison of pollution emissions from jet engine aircraft operation and from other sources is presented.

77 APTIC NUMBER 17314

Eguchi, Yoshitomo
TREATMENT OF NOXIOUS GASES BY AN ACTIVATED CHARCOAL. (Kasseitan ni yoru yugaigasu no shori). Text in Japanese. Nenryo Oyobi Nensyo (Fuel and Combustion), 36(10):937-950, Oct. 1, 1969. 10 refs.

Present investigations of gaseous atmospheric contaminants are inadequate because they are limited to gases which can be easily measured or which have an offensive musty odor. The range of contaminants is greater than assumed and increasing year after year. On frequent occasions, harmful gases contaminate the atmosphere in working and living quarters. With regard to the disposal of harmful gases by the activated charcoal method, fields of application include the elimination or recovery of organic solvents generated in chemical plants, following: prevention of emission of gasoline vapors discharged by automobiles; prevention of release of radioactive gases discharged from atomic installations, and elimination of harmful gases in indoor environments. The present status of

the activated charcoal process in these fields is described and cost estimates are given.

78 APTIC NUMBER 15629

Eisner, Joachim H.
DUST EXTRACTION IN CEMENT WORKS. (Enstaubung von Zementwerken). Text in German. Wasser Luft Betrieb, 13(11):433-439, 1969.

Various dust separators used in cement factories, and their structural design and special uses are discussed. The operating principles and various components of electrostatic precipitators, cyclones, and packed towers are reviewed. Electrostatic precipitators, which have become the most efficient dust separators for the cement industry, may be horizontal or vertical to the flow of gas. The vertical type must have a larger filter surface. The ventilator here is usually installed in the exhaust gas duct, which leads to more rapid wear. This version is advantageous only if there is danger of explosion; otherwise, the horizontal type is preferable in all respects. Cyclones are now used in a cement factory only for preliminary dust separation. Their collection efficiency is improved by a larger specific weight of the dust, a larger speed, smaller cyclone diameters, larger dust grains, and by a lower dynamic viscosity of the carrier gas. They can be used for dust concentrations of less than 1000 g/cu m. Packed towers can be used only at temperatures below 350 C; collection efficiencies of 99.9% can be obtained, and the dust content can be reduced to 50 mg/cu m, but their costs run extremely high. In almost all instances in the cement industry, the high collection efficiency can be more economically obtained with electrostatic precipitators.

79 APTIC NUMBER 17212

Enke, Gg.
RETROSPECT OF THE TECHNICAL SHOW 'KEEPING AIR CLEAN' IN DUESSELDORF: AIR ENGINEERING EQUIPMENT FOR THE CLASS, ENAMEL AND CERAMIC INDUSTRY. (Rueckblich auf die Fachausstellung 'Reinhaltung der Luft' in Duesseldorf: Lufttechnische Einrichtungen fuer die Glas-, Email- und keramische Industrie). Text in German. Glas Email Keramo Tech., 20(12):427-429, Dec. 1969.

New designs or improvements of equipment by various companies, exhibited at the Duesseldorf show 'Keeping Air Clean', were as follows: a 'KM2' concentration meter which measures gas concentrations and signals when preset values are reached; an Auer Fr-Alarm monitors, a closed space for combustible gas; a gas sampler for temperatures up to 900 to 1100 C; a dust monitor FH62-A; a flame-ionization detector; and a 'Microgas MSK-SO2' for SO2 measurement and recording. All-metal catalysts oxidize, for example, the vapor of a solvent present in the waste gas of a drying oven. A bubbling absorber removes, for example, HCl-bearing waste gas from a HCl pickling plant. Schnakeuberg absorbers remove SO2-bearing waste gas or odoriferous substances and the like. Air cleaner systems remove chemical vapors, gases dust, and can be built of stainless steel. The 'HKL' air cleaner works on the wet principle and can be built for temperatures up to 300 C. 'VDN' wet dust separators work on the venturi principle and the water can be recirculated many times without a water pump. The lamellar separator is formed at two or more sets of equidistant lamellae placed at an angle to the direction of the impinging gas stream and separates, with or without recovery, droplets, mists, aerosols and dusts from utility or waste gases. Fabric filters attain degrees of dust removal of 99.9% and higher, the residual dust content of the filtered air or gas being less than 25 mg/cu m. Some gas filters work at temperatures up to 250 C and have automatic pressure-difference cleaning. The 'BHS-Downflow-Area Filter' has a continuously scanning cleaning nozzle, leaving more than 90% of the filter area in service at all times.

80 APTIC NUMBER 16942

Feld, Walther and Anton Jahl
PROCESS OF RECOVERING SULFUR. (Walther Feld) U. S. Pat. 927,342. 4p., July 6, 1909. (Appl. Feb. 28, 1908, 13 claims).

A process is described for obtained sulfur from sulfur dioxide and hydrogen sulfide by passing these gases through liquid having the power to dissolve the sulfur as it is produced according to the reaction 2H2S + SO2 yields 3S + 2H2O, so that the formation of thio-sulfate, or poly-thionic acids is almost completely prevented. The most suitable liquids for the purpose are tar-oils obtained from the distillation of organic matter and consisting of mixtures of hydrocarbons. While the process is usually facilitated by moderately heating the reacting liquid, it may be carried out at any convenient temperature. A basic substance may be added to the liquid, but when a sulfite is added, care should be taken that the reacting liquid is kept acid. An example is given in which tar bases are added to the initial tar-oil; in order to bind sulfuric acid which may exist in the SO2, sodium carbonate is added. The oil thus prepared is then heated to 40 C. An apparatus for carrying out the process is diagrammed, although others are possible.

81 APTIC NUMBER 17137

Flint, D., A. W. Lindsay, and R. F. Littlejohn
THE EFFECT OF METAL OXIDE SMOKES ON THE SO3 CONTENT OF COMBUSTION GASES FROM FUEL OILS. J. Inst. Fuel, 26(152):122-127, Sept. 1953. 15 refs.

The present work was undertaken to provide quantitative data on the influence of various additives to the fuel burnt, as a method of decreasing the quantity of sulfur trioxide. Measurements were made with a dew-point meter on three relatively small oil-fired appliances. Two of these were sectional boilers and the third, on which most of the work was done, was a refractory furnace. Five oils, varying from a heavy fuel oil (3.5 per cent sulfur) to a gas oil (0.75 per cent sulfur) were burnt in the refractory furnace and a dew-point of the combustion products was in the range 250 to 300 F. Measurements on the gases from the heavy fuel oil, treated with soda residue (AS); calcium residue (AC); commercial zinc naphthenate (AZ), showed that the latter alone was successful in decreasing greatly the amount of SO3. Under good combustion conditions there was no acid dew-point when burning oil containing

0.14 per cent zinc (by weight). With 0.07 per cent zinc the amount of SO3 was still very low, a dew-point of 160 F being measured. (Author abstract modified)

82 APTIC NUMBER 16943

Francis, Wilfrid
THE REMOVAL OF SULPHUR COMPOUNDS FROM INDUSTRIAL GASES.
Engineering (London), vol. 172:180-182, Aug. 10, 1951. 3 refs.

Six processes are described for recovering sulfur from coke-oven and refinery gases. The I. G. active charcoal process is applicable to many types of gas and is based on the low-temperature oxidation of hydrogen sulfide in thhe presence of active charcoal. High-quality sulfur is produced; the main limitation is the maximum concentration of H2S permitted, equivalent to 8 grams/cu ft. The Girbotol process is another physical process in which a solution of triethanolamine is used as the scrubbing medium. The process is simple, the solution used long-lasting, and the treated gas contains high proportions of H2S that is readily convertible to either sulfur or sulfuric acid. In the Seaboard process, the gas is passed up a scrubbing tower; a dilute solution containing 2-4% sodium carbonate passes down the tower and dissolves the H2S to form sodium-H2S and sodium bicarbonate from which sulfur can eventually be recovered. Some problems arise from the use of dirty gas and the corrosion of metal parts. In the Ferro process, a development of the Seaboard process, the H2S is removed by scrubbing with a dilute solution of sodium carbonate containing a fine suspension of iron oxide. The sulfur product is of poor quality and some aeration and oxide-handling problems arise, but its most likely application is for combustion to sulfur oxides for use in a contact sulfuric acid plant. The Thylox process is similar to the Ferrox process except that arsenious oxide is used in solution in place of iron oxide in suspension; the sulfur and waste liquors can be used for insecticidal purposes. The caustic-soda wash process, where the soda removes the H2S as sodium-H2S, may be used where high concentrations of H2S are present. The mercaptides formed in the presence of organic gases must be removed completely from solution in order to sell the hydrosulfide solution readily.

83 APTIC NUMBER 17266

Freyshut, Sting
PROTECTION OF NATURE IN SWEDEN -- SYSTEM AND RESEARCH. (Sueden ni okeru shizen hogo -- soshiki to kenkyu). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 6(1):13-17, Jan. 1970.

Several new systems developed for Swedish pulp manufacturing plants are detailed. There are some problems existing in the process of stripping, bleaching, and dehydrating solids. Moreover, the waste water from a pulp manufacturing plant contains liquid used for the raw pulp boiling process, fibrous materials, and bark from the bleaching process. The effect of a new system for reducing the amount of waste liquid is illustrated by a multiplex elutriation installation which works for both digestion and filtration. High purification efficiency is decisive in producing pulp of high quality and in this respect a new system of dispersion purification offers the following advantages: an ideal method of pure water supply, adequate time for elutriation and sufficiently high temperature of the water used for elutriation. This dispersion elutriation system is distinguished by a device that excludes outer air and foam generation to attain maximum purification efficiency. In this system, nothing but pulp is disposed to air, there are no odor problems and foaming trouble and, consequently, the initial filter water is able to be recirculated, decreasing fresh water demand for purification by perhaps 80%. This means a reversely proportional decrease of waste water inflow to the settling tank. A problem existing in a kraft plant which produced between 2 and 3 kg mercaptans and sulfuric compounds per one ton of pulp was solved by application of vapor-stripping system in which separated sulfuric compounds and hard-to-thicken gaseous refuse are incinerated; the sulfuric compounds are oxidized by controlling incineration conditions. A cooperative system for industrial pollution involving industry and control officials is briefly outlined.

84 APTIC NUMBER 16834

Friedrich, H. E.
AIR POLLUTION CONTROL PRACTICES. HOT-MIX ASPHALT PAVING BATCH PLANTS. J. Air Pollution Control Assoc., 19(12):924-928, Dec. 1969. 3 refs.

Hot-mix asphalt paving plant operation and the associated air pollution control problems are presented. Field observations and test data are included for full scale installations. Comparisons are made for various types of control equipment and their effectiveness. The dry cyclonic units offer the least cost expenditures, lowest space requirements, and can collect the fines in a usable condition. Wear can often be a problem, and their efficiency capabilities limit their use as total collection devices. They no longer are suitable as total collection units in many localities. Their role is being relegated to that of primary and secondary collectors. Wet collectors of several types, particularly the more sophisticated and high energy units, are capable of satisfying higher efficiency requirements. They offer space advantages and are in the medium cost range. Wear is generally no problem, however, corrosion can be a problem depending on the amount of sulfur in the rotary dryer burner fuel. Settling tanks, ponds or pits are necessary for settling of the collected dust. The dust, as collected, is not readily reusable as mineral filler in the mix. Fabric collectors are capable of satisfying the most stringent codes. They offer the greatest cost advantage for material recovery to be used as mineral filler. First cost and space requirements of fabric filters are highest of the three classes of equipment discussed. (Author's Abstract)

85 APTIC NUMBER 16638

Fuchs, O.
MORE RECENT DEVELOPMENTS OF SCRUBBING METHODS FOR GASES. (Die neuere Entwicklung der Waschverfahren fuer Gase). Text in German. Gas Wasserfach (Munich), 80(2):18-24, 1937. 20 refs. (Presented at the Hauptversammlung des Vereinsbezirke Hessen, Saar-Pfalz und Suedwestdeutschland des Deutschen Vereins von Gasund Wasserfachmaennern, Bingen, Sept. 26, 1936.)

The theory of scrubbers and of packed columns is discussed. The concentration of the substance washed out from the gaseous phase must be equal to the concentration of the same substance in the scrubbing liquid in all scrubbing methods. This equilibrium differs from case to case and must be measured in the laboratory. All theoretical discussions frequently overlook the fact that the scrubbing liquid is heated by the dissolution of the gaseous substance. For the explanation of the scrubbing process in packed towers, the two-film theory deals only with the physical process of absorption. If this process is followed by a chemical process such as hydration of CO2, the theory by Davis and Crandall is used. It states that such reactions take place in a small zone in the liquid film and do not interfere with the absorption process. Benzene is best removed with oils such as tetraline. Hydrogen sulfide is removed from the gas by the so-called 'Thylox' process which uses the sodium or ammonium salts of the thioarsenates. The reaction follows the equation Na4As2S5O2 plus H2S yields Na4As2S6O plus H2O. The scrubbing material is recovered with air according to the reaction Na4As2S6O plus 1/2O2 yields Na4As2S5O2 plus S. Carbon dioxide is removed with a solution of potash. Fly ash and SO2 are removed from the gas by scrubbing with alkaline water (calcium milk is added to the water).

86 APTIC NUMBER 17025

Fukazawa, Shoichi, Tadashi Murayama, Kunimasa Yoshimura, and Karuzo Mizuno
EXPERIMENTS ON REDUCTION OF VEHICLE EMISSIONS. PART 3. ON A FEW TRIALS OF THE COMBUSTION IMPROVEMENT UNDER IDLING CONDITIONS. (Jidosha no taiki osen boshi ni kansuru jikken dai 3 ho aidoringu untenji no nensho kaizen ni tsuite). Text in Japanese. Jidosha Gijutsu (Automobile Eng.), 23(10):976-981, 1969. 4 refs.

A mechanism for providing wider throttle opening was devised to maintain a stable engine idle while running with a leaner mixture. The methods available were retarded ignition, heating of the intake air, and heating of the mixture. The advantages and disadvantages of the three methods are discussed and compared and the effects on carbon-monoxide emission given. Idling-screw adjustment procedures also were studied. (Author abstract modified)

87 APTIC NUMBER 17026

Fukazawa, Shoichi, Tadashi Murayama, Yoshihiko Doi, and Masayoshi Kido
EXPERIMENTS ON THE REDUCTION OF VEHICLE EMISSION. PART 2. COMBUSTION BEHAVIOUR UNDER IDLING CONDITIONS. (Jidosha no taiki osen boshi ni kansuru jikken dai 2 ho: aidoringu untenji no nensho ni tsuite). Text in Japanese. Jidosha Gijutsu (Automobile Eng.), 23(2):107-112, 1969. 5 refs.

Leaner mixtures and stable combustion are necessary to reduce emissions of hydrocarbons and carbon monoxide under idling conditions. Leaner mixtures and reduced CO emissions can be accomplished with retarded ignition which causes a reduction of thermal efficiency. To keep the engine revolution constant, an increased opening of the throttle valve is required to compensate for the output reduction. With the same mixture ratio (measured on the intake side), increased new charge, lower CO concentration, and higher exhaust temperature reduce combustion variation. Higher idling rpm was not effective for the reduction of CO emissions. (Author abstract modified)

88 APTIC NUMBER 17300

Fukuma, Shinichi
DESULFURIZATION OF EXHAUST GAS. (Haigasu datsuryuho ni tsuite). Text in Japanese. Nenryo Oyobi Nensyo (Fuel and Combustion), 36(8):789-794, Aug. 1, 1969.

The use of fuel oil low in sulfur is desirable in reducing air pollution, but not practical in Japan where crude oil with a high sulfur content is imported from the Middle East. The use of ultrahigh chimneys to disperse exhaust gases does not decrease the quantity of exhaust, so tall stacks do not represent a fundamental control measure. Desulfurization of exhaust by chemical treatment is even preferable to low-sulfur fuel, for it reduces the sulfur dioxide content by 90%. However, the method presents difficulties in actual practice. Wet desulfurization is technically possible, but the dry method is currently under development. Conditions of the desulfurization process are as follows: (1) the cost of construction must be small, and the construction site required must be narrow; (2) the process must be simple, and the desulfurization rate must be high; (3) operating and maintenance costs must be small; (4) by-products of value must be recovered. The cost of construction of the wet method is small, and the process is relatively simple and suitable for a factory with little exhaust. The cost of construction of the dry method, on the other hand, is large and the process is complex. But the temperature of exhaust after treatment is high, and the exhaust can be dispersed. The method is suitable for districts of high potential pollution by SO2 and for factories emitting large volumes of exhaust.

89 APTIC NUMBER 17127

Gaw, R. G.
GAS CLEANING. Iron Steel Engr., 37(10):81-85, Oct. 1960.

Wet and dry process dust collection systems are evaluated for use in steelmaking, where the use of oxygen to speed up molten bath reactions greatly increases the dust and fume generation, with the dust consisting principally of extremely fine iron oxides. In determining the gas volume of a dust collection system, a design volume rating of 25 scfm of waste gases per cfm of oxygen blown is in general use for electrostatic precipitators; for scrubber applications, a lower ratio of 20 to 1 is sometimes used. When designing gas cleaning systems for oxygen converters, allowance should be made for future increases in blowing rates. The venturi wet scrubber and the dry electrostatic precipitator systems are described and diagrammed, evaluated, and their costs compared. Best available figures indicate that the total installation cost of a wet scrubber designed for identically sized vessels and blowing rates would be about the same as for a dry precipitator system. In operating and maintenance costs per ton, the wet scrubber is rated at 14¢, the dry system at .08¢, with use of the dry dust, which has a market value of about $15./ton. Advantages

of the wet scrubber system are smaller space requirements, tolerance of smaller volumes of exhausted gas, and lower installation costs; those for the dry system are smaller operating costs, flexibility of operation, more effective cleaning, no excessive steam plume, the ability to by-pass gases, the recovery value of the dust, and elimination of potentional stream pollution problems.

90 APTIC NUMBER 17130

Goldman, Max, L. M. Canjar, and M. B. Beckmann
KINETICS OF CATALYTIC OXIDATION OF SULPHUR DIOXIDE FOR COMPARISON OF FIXED AND FLUID BED REACTORS. J. Appl. Chem. (London), 7(5): 278-284, May 1957. 20 refs.

The kinetics of the oxidation of sulfur dioxide over a commercial vanadium catalyst in confined and fluidized beds was investigated under various operating conditions. The reaction rates for both the confined and the fluidized operation were correlated by an equation based on the assumption that the reaction rate was controlled by the specific surface reaction between activatedly adsorbed atomic oxygen and activatedly adsorbed sulfur dioxide at high mass velocities where diffusional effects are negligible. The general rate equation is given. The individual reaction rate data were correlated by assuming the adsorption equilibrium and reaction velocity constants were the same for both the confined and the fluidized operations. The developed rate equations differ only in the effectiveness factors for the specific mode of gas-solid contacting. The study gives some insight into the practical problem of applying fixed bed catalytic data to fluidized operation in the absence of fluidized bed data or vice versa. It also demonstrates the possibility of correlating fixed and fluidized bed data with a single parameter. It is doubtful if, as is generally supposed, a fluidized bed under low mass velocity conditions behaves as a fixed bed. (Author abstract modified)

91 APTIC NUMBER 16823

Grainger, J. A., B. W. Bulmer, and A. Gurson
FUMELESS REFINING IN ELECTRIC ARC FURNACES WITH OXY-GAS BURNERS. J. Inst. Fuel, 42(340):200-206, May 1969. 9 refs.

The development is described of a suitable design of oxy-gas burner for the refining of molten steel in electric arc furnaces without giving rise to the copious emissions of red oxide fume associated with conventional oxygen lancing. The burner is relatively simple and cheap to construct, and works equally well on town and natural gas. The amount of carbon removed from the molten bath can be predicted with sufficient accuracy for routine production purposes. The running cost is shown to be no greater than that of conventional lancing, although the time taken to remove a given amount of carbon is approximately doubled. The relatively low oxygen pressure needed to obtain good mixing of oxygen and fuel avoids any violent upheaval of the bath resulting in lack of damage to both the furnace refractories and the burner. The efficiency of fume elimination has been enough to secure official approval for the technique and the apparatus. Some tentative reasons are advanced for the absence of fume during oxy-gas refining. (Author's Abstract)

92 APTIC NUMBER 16642

Guentheroth, Hans
NEW EXPERIENCES WITH VENTURI SCRUBBERS FOR FINE CLEANING OF GASES FROM COKING PLANTS. (Neuere Erfahrungen mit Venturi-Scrubbern fuer die Feinstreinigung von Gasen im Kokereibetrieb). Text in German. Dechema Monograph, 48(835-858):329-345, 1963. 4 refs.

The use of PA(Pease-Anthony) venturi scrubber for the separation of tar and naphtalene is described. Coke oven gas is cooled to 35 C, pre-scrubbed, and passed to the PA venturi scrubber, where oil is used as the scrubbing liquid. An average of 0.7 cu m/1000 standard cu m gas are supplied to the scrubber and circulated. About 1/20th of the scrubbing oil is removed per hour for regeneration. The venturi scrubber is operated with a differential pressure of 240-300 mm water. Tar mists are removed to a residual concentration of 30 mg/standard cu m gas; the napthalene is absorbed to a residual amount of 160 mg/standard cu m corresponding to a napthalene dew point of 11 C. This degree of purity is adequate for metallurgical plants, since the temperature in the final coolers is 23 C and never drops below 11 C in the distribution network. It is inadequate for long distance transmission of gas. Such venturi scrubbers were installed by a steel manufacturing company in Gary, Indiana. Two test series studying the efficiency of this type of venturi scrubber for the separation of tar showed the great influence of saturation and cooling. The performance of the scrubber could be improved by pre-cooling the gas prior to its passage through a saturating device. After saturation with scrubbing liquid, the gas is further cooled before it goes to the actual PA venturi scrubber. In conclusion, a novel process for the removal of CN and soot is described from which the gases leave with a residual soot content of 1 mg/standard cu m.

93 APTIC NUMBER 16809

Haecker, C. F.
IRON MELTING AND POLLUTION CONTROL: AN OPPORTUNITY TO PROGRESS. Foundry, 97(8):56-59, Aug. 1969. 2 refs.

Pollution codes can be viewed as a burden or a challenge. The need to meet the challenge is the most frequent motivation for melting modernization today. An hypothetical analysis is presented of the economics of the three types of melting equipment available for ferrous melting, the cupola, the arc furnace, and the induction furnace, as they are affected by air pollution control equipment.

94 APTIC NUMBER 16746

Halzel, George C.
FLYASH DISPOSAL. Power Eng., 73(6):44-46, June 1969.

Disposal of fly ash from large power plant boilers is becoming a serious problem for plant designers and municipalities. Surface

disposal in ash ponds and ash piles sometimes are sources of dust and air pollution which is objectionable. Commercial uses for fly ash have been explored but only a small portion of the fly ash produced can be consumed in this way. The Duquesne Light Company at its Colfax Station is now disposing of fly ash by sluicing it from the station into an abandoned section of a coal mine. The disposal system and the mine dewatering system are described. When the new Cheswick Station is put into operation the disposal problem will be increased substantially. The company estimates that at that time it will realize a $700/day saving over conventional disposal costs.

95 APTIC NUMBER 16317

Hanf, Edward B.
A GUIDE TO SCRUBBER SELECTION. Environ. Sci. Technol., 4(2):110-115, Feb. 1970.

The following major types of wet scrubbers are described, along with their most efficient pollution control uses: cross-flow, counter-current, wet cyclone, venturi, and verticle air washers. For the removal of mists and entrained particles, cross-flow scrubbers give satisfactory efficiency at low operating costs. The concurrent packed scrubber, a modification of the counter-current design, can be operated at high gas rates and, in the case of gas absorption, at high liquid rates. It easily removes gases of high water solubility and is efficient for the removal of less soluble gases. Wet cyclone scrubbers are efficient for removing entrained liquids and dusts from air streams, while venturi scrubbers are best suited for solid or liquid particulates in the .05-5 micron range. The verticle air washer is a low-cost design used primarily for removing liquid particulates (entrainment, carryover, and mists) from air streams in metal finishing and plating operations. The main advantages of wet scrubbers are constant exhaust volume, elimination of secondary dust problems during disposal, small size, and ability to clean hot or moisture-laden gases. Of the construction materials available for scrubbers in corrosive service, the most suitable is glass fiber reinforced polyester.

96 APTIC NUMBER 16745

Mansford, R. C., D. A. Gaudio, T. V. Inwood and V. T. Mavity, Jr.
UNISAR'S NEW HYDROGENATION PROCESS SATURATES AROMATICS IN JET FUEL. Oil Gas J., 67(18):134-136, May 5, 1969. 1 ref.

A new, highly effective hydrogenation process is now available for saturating aromatic hydrocarbons present in turbine fuel stocks and in solvent naphthas. The process offers improved solvent properties with lower investment costs, higher yields, lower operating costs, and lower catalytic reactor temperatures, with multiple catalyst beds disposed between suitable hydrogen-quench trays. Reactor temperatures range from 400 to 700 F and operating pressures from 400 to 1200 psig. The process is of interest not only because of the rapidly expanding demand for jet fuel, but also because of the restrictions imposed on the aromatic hydrocarbon content of industrial solvents by air pollution authorities.

97 APTIC NUMBER 16744

Hawkins, Gerald
SCRUBBER LICKS TOUGH FUME PROBLEM. Plant Eng., 23(13):70, June 26, 1969.

In the production of pulp by the kraft process, black liquor evaporators are a low-volume, highly concentrated source of air pollution. A noncondensable gas scrubber system to be used at the end of an evaporator train is described. Non-condensable gases leave the surface condenser, pass through a pre-cooler, into and through two jets and then into the gas scrubber system. A weak solution from causticizing production is used as a scrubbing medium. Typical performance is: H2S at the inlet 428 lb/day, at the outlet 1 lb/day; CH3SH 438 lb/day at the inlet, 2 lb/day at the outlet.

98 APTIC NUMBER 15649

Hayashi, Tesshi
A SMOKE COLLECTOR. (Shuen sochi). Text in Japanese. (Mitsubishi Heavy Industries, Ltd., Tokyo (Japan)) Japanese Pat. Sho 44-12249. 5p., June 3, 1969. (Appl. Aug. 5, 1966, claims not given).

The present invention improves the operations of a smoke collector employed in a tilting furnace, such as an electric furnace for making steel. A fixed stationary duct is connected to a movable duct, which leads to the smoke source. The cross-sectional area of the stationary duct at the junction is larger than the corresponding cross-sectional area of the movable duct. The movable duct is connected to the stationary one in such a way that the former can slide along the latter with a seal between them, preventing the outside air from entering the ducts. The device has a simple construction and is very effective in collecting smoke. These features make the present invention attractive in industrial applications.

99 APTIC NUMBER 16932

Hellstrom, Arne G.
USE OF ABSORPTION TOWERS FOR RECOVERY OF PRESSURE RELIEF GASES. Pulp Paper Mag. Can. (Quebec), 47(3):119-122, 1946. 1 ref. (Presented at the annual meeting of the Technical Section, Canadian Pulp and Paper Association, Montreal, Jan. 24-26, 1946.)

The use of a pilot plant absorption tower for recovering sulfur dioxide and heat from the low pressure and accumulator relief gases obtained from sulfur pulping is presented. The results indicated that a tower containing ten ft of Raschig ring packing is sufficient to absorb 90% of the sulfur dioxide in the relief gases. The absorbing medium used was raw calcium bisulfite acid, at an approximate rate of 40 lb/min/sq ft cross-sectional area of the tower. Two commercial towers were designed from the data obtained from the pilot plant. These towers have been in operation for almost three years. Their effect on operation in the sulfur mill and agreement, or otherwise, with pilot plant predictions are discussed. The experimental SO2 absorption

tower and a cross-sectional view of a commercial absorption tower are illustrated. The design and operation of the pilot plant, the design and operation of the commercial tower, the effect of the commercial tower on mill operation, and tower maintenance are discussed. (Author abstract modified)

100 APTIC NUMBER 16035

Higbie, Ralph
THE RATE OF ABSORPTION OF A PURE GAS INTO A STILL LIQUID DURING SHORT PERIODS OF EXPOSURE. Trans. Am. Inst. Chem. Engrs., vol. 31:365-389, 1935. 28 refs. (Presented at the Eagle-Picher Lead Co. Meeting, Wilmington, Del., May 13-15, 1935.)

In a study of liquid-film resistance, the primary absorption mechanism in the liquid phase of gas absorption was analyzed theoretically and experimentally under conditions approximating those of absorption in bubble absorbers, spray absorbers, and packed towers. The absorption of carbon dioxide in distilled water was measured at 10 and 25 C and at runs of 25 to 40 cycles of operation. The experimental work shows that the amount of absorption consistently falls below theoretical values predicted by the penetration theory. For the two shortest periods at each temperature, from .007 and .032 sec, the amount of CO2 absorbed is approximately half the theoretical value; as the period increases, the amount absorbed becomes more nearly theoretical. The progressively greater deviation from penetration theory indicates an additional surface resistance to absorption which is especially effective for short periods. Gas passing through the surface evidently goes through a first order process whose rate is proportional to the degree of unsaturation or removal from equilibrium at the surface. Since the maximum or initial rate of absorption is approached by shortening the time of exposure, it is concluded that more agitation beyond a certain degree is useless. In such a case, the capacity problem is one of obtaining the optimum surface. For longer periods of exposure (more than 0.2 sec for Co2), the effect of gas diffusiy must be considered.

101 APTIC NUMBER 16973

Hiraoka, Masakatsu, Yoshizo Matsuno, and Gensuke Nishisori
AN EXPERIMENTAL STUDY ON COLLECTION EFFICIENCY BY MODEL FILTER. Mem. Fac. Eng., Kyoto Univ., vol. 30, part 3:219-234, Sept. 1968. 7 refs.

The mechanism of aerosol particle separation was studied with an experimental filter composed of glass fibers attached to a brass plate. The diameters of the fibers were 40 and 80 micron, and the porosity of the filter was 0.75-0.88. The diameters of the stearic acid aerosols used in the experiment were 0.7 and 1.0 micron. When collection efficiencies were plotted against Reynold numbers, minimum collection efficiency was indicated for numbers between 0.3 and 0.5. The order of collection efficiencies was 0(0.01), or less than the efficiency calculated for collection due to inertia and interception. This suggests that the collection mechanism is complex and presumably influenced by factors such as the interference effect between fibers and particle coagulation. The experimental results were theoretically analyzed according to Fucks' theory of collection by impingement, and an equation was derived to fit the experimental data. The failure of the equation to fit data obtained by other investigators is attributed to the use of high particle concentrations and dense filters.

102 APTIC NUMBER 15870

IMPROVEMENTS IN AND RELATING TO THE RECOVERY OF SULPHUR DIOXIDE FROM GAS MIXTURES. (Imperial Chemical Industries Ltd., London, England) British Pat. 506,002. 3p., May 19, 1939. (Appl. Nov. 19, 1937, 8 claims).

The recovery of sulfur dioxide from gas mixtures by the alternate absorption in and expulsion from an absorbent liquor is described. The absorbent liquor consists of an aqueous medium and one or more water-immiscible organic bases, e.g., aniline, quinoline, or crude xylidine. To reduce the loss of organic bases following the removal of sulfuric acid precipitated in the form of calcium sulfate, the absorbent liquid is separated into an aqueous layer and an organic base layer by expelling the sulfur dioxide which it contains. The aqueous layer is treated in the presence of dissolved sulfur dioxide and a neutral sulfate with a calcium compound. The amount of sulfur dioxide present is enough to prevent any precipitation of the organic bases as a result of the addition of the calcium. Because of the pressure of neutral sulfate it is possible to remove an amount of calcium sulfate that is equivalent to the amount of sulfuric acid in the aqueous layer. This produces a sulfite of the neutral sulfate base which neutralizes more sulfuric acid as it is produced in the liquor. The treated aqueous layer is then returned along with the organic base layer for re-use in the absorption process. The sulfuric acid concentration of the circulating does not exceed 0.25 gr per liter.

103 APTIC NUMBER 17235

Isino, Toru
DUST EMITTED BY CUPOLA OPERATION AND ITS COLLECTOR. (Kyupora haigasu no baijin to sono shujinsochi nitsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(6):427-432, June 15, 1969. 4 refs.

Dust and gas emitted by a cupola furnace were measured; several collectors were evaluated. The cupola used for the measurement had a melting capacity of 1 t/hr. Actual steel manufacturing was never done during the measurements. Ten measurements were taken for each operating condition. In the middle position, between the material inlet and the top of the cupola, all quantity sampling of dust, gas temperature, and gas velocity were done according to the Japanese Industrial Standard Z8808. Dust was sampled by a dust tube filled with quartz wool, and the tube was weighed by a balance. The mean value of dust weight per cu nm of exhaust gas was 1.95 grams. The sulfur content of the exhaust gas was 25 to 250 ppm. Gas temperature was 500 to 700 C. Both types wet and dry collectors were employed. The wet method yielded a better efficiency than the dry method and consisted of a conical cap on top of the cupola, a hood surrounding it, and a water spray nozzle over the cap. Four kinds of spray nozzle were tried,

including slit, shower, centrifugal, and reverse jet type. The best collecting efficiency was obtained with the centrifugal nozzle. The collecting efficiency was 90 to 90.6%; the total quantity of the dust was 0.38 to 0.79 g/cu m, and the dust emitted through the collector was 0.04 to 0.07 g/cu m. Stainless steel is recommended as the construction material and calcium salt as the neutralizing agent.

104 APTIC NUMBER 16672

VDI (Verein Deutscher Ingenieure) Kommission Reinhaltung der Luft, Duesseldorf (Germany), Emissionsausschuss der Carbidindustrie
DUST EMISSION CONTROL IN CALCIUM CARBIDE PRODUCTION.
(Staubausuurfbegrenzung bei der Herstellung von Calciumcarbid). VDI (Ver. Deut. Ingr.) Richtlinien, no. 2111, 6p., Dec. 1965. 6 refs. Translated from German by H. Schneider, Israel Program for Scientific Translations, Jerusalem.
CFSTI: TT 68-50469/2

The following dust-laden gases are generated during the production of calcium carbide: (1) carbon monoxide is the noncombusted reaction gas not mixed with air; (2) furnace waste gas is the combusted gas as mixed with air; and (3) tapping fumes are substances evaporated during the tapping of the furnace, as mixed with air. Covered furnaces, the most recently developed of the types used, yield no waste gases; semicovered and uncovered furnaces do, however, and should not be used in any new plant construction. Control devices in current use for removal of dusts from furnace waste gases are dust chambers, cyclones, and mixed-bed filters. Filter cartridges and wet scrubbers are used for dust removal from CO. Electrostatic precipators are being tested for use in cleaning tapping fumes, but no operational device for fume elimination is now available. Much dust is generated in plants where quicklime and coke, anthracite, and other coal-like raw materials for CaC2 production are prepared by such processes as crushing and mixing; cyclones, multiclones, and mixed-bed, panel, and bag filters are used for dust control in these plants. A dust emission limit value of 200 mg/cu m STP is given for the CO gas from covered and semicovered furnaces; there is no CO from uncovered furnaces as the furnace is open. Semi-covered and uncovered furnaces are given a limit of 350 mg/cu m STP for dust emission in furnace waste gases, and the limit set for preparation plants is 150 mg/cu m STP. No limits for tapping fumes from any of the furnace types are set because of the lack of any control method.

105 APTIC NUMBER 13542

Jean-Pierre, Rene, Jean Solinhac, Georges Holinet, and Rene Terminet
PROCESS FOR THE RECOVERY OF GASEOUS SULPHURIC COMPOUNDS PRESENT IN SMALL QUANTITIES IN RESIDUAL GASES. (Societe Nationale des Petroles d'Aquitaine, Paris (France)) U. S. Pat. 3,363,401. 3p., Jan, 16, 1968. 8 refs. (Appl. Jan 6, 1965, 3 claims).

A process is described for the removal of vesicular sulfur and gaseous sulfuric compounds from residual gases. The gas is contacted with an adsorbent, which may be mixtures of silica and alumina, at a temperature ranging from room temperature to 150 C. After adsorption, the catalytic material is heated to desorb the sulfur compounds and regenerate the adsorbent. This process eliminates the need for complicated or expensive control equipment, and the recovered sulfur compounds that would otherwise be lost, can be utilized in various plant operations.

106 APTIC NUMBER 16938

Johnstone, H. F. and H. E. Silcox
GAS ABSORPTION AND HUMIDIFICATION IN CYCLONE SPRAY TOWERS. Ind. Eng. Chem., 39(7):808-817, 1947. 14 refs. (Presented at the Division of Industrial and Engineering Chemistry, 109th meeting of the American Chemical Soc., Atlantic City, N. J.)

Measurements were made in a model cyclone tower on the rates of absorption of sulfur dioxide by alkaline solutions and on humidification of the gas. The effect of entrance design, gas and liquor velocities, and nozzle spacing are correlated in such a manner that the performance of large towers can be predicted. The towers provide high rates of absorption as well as good efficiency for the removal of finely divided dust particles. They may be operated over a wide range of conditions and loading ratios of liquid to gas. Their simplicity and low pressure losses should make them useful in the chemical industry for treating large quantities of gases. (Author abstract modified)

107 APTIC NUMBER 16651

Johnstone, H. F. and A. D. Singh
RECOVERY OF SULFUR DIOXIDE FROM WASTE GASES. DESIGN OF SCRUBBERS FOR LARGE QUANTITIES OF GASES. Ind. Eng. Chem., 29(3):286-297, March 1937. 24 refs.

Conventional tower packing is designed to give maximum gas absorption rates but without regard to the following variables that are important in treating large volumes of gas: minimum pressure drop, minimum quantity of solution for maintaining wetness, material corrosion, minimum cross section, open channels, low weight, and resistance to crystal growth. These items enter into the choice of contact surfaces, and final scrubber design requires a knowledge of the cost contribution of each. Measurements of the rates of absorption and draft losses are reported for a number of available scrubber surfaces. They include vertical smooth plates; vertical corrugated plates set at various spacings and with different depths of corrugation; grid surfaces of various depths and spacings; and ordinary packings such as Raschig rings, spiral rings, and wire helices. The absorption data on sulfur dioxide by alkaline solutions and on ammonia by acid solutions were found to be accurately correlated with heat transfer data by the Chilton-Colburn equation. The most desirable packing of those studied was found to be grids with 1.5-in. channels and with individual sections from 4 to 6 in. high.

108 APTIC NUMBER 16968

Johnstone, Henry F.
RECOVERY OF SULFUR DIOXIDE CONTAINED IN WASTE GASES. (Texas Gulf Sulphur Co., New York) U. S. Pat. 2,676,090. 18p., April 20, 1954. 4 refs. (Appl. Jan. 26, 1953, 15 claims).

A process was invented for the recovery of sulfur dioxide from waste gases resulting from combustion of sulfur-containing coal or the roasting or sintering of sulfur-containing materials. The waste gas is reacted with an aqueous ammonia solution in two or more zones. The gases are sequentially passed from the first zone to the second zone where the gases are absorbed by the ammonia solutions. A solution of ammonium sulfite is formed and divided into two portions. Sulfuric acid is added to the effluent solution and ammonium sulfate and sulfur dioxide is formed. Sulfur dioxide is separated from the solution leaving a residual solution of ammonium sulfate which is crystallized and recovered. Sulfur dioxide mixed with water vapor is stripped from the second portion of ammonium sulfite solution by heating. The water vapor is condensed and the separated sulfur dioxide is collected. The condensate, composed predominately of ammonia, is recycled to the second zone. The residual ammonia solution is recycled into contact with the waste gases in the first zone.

109 APTIC NUMBER 16759

Jones, Donald W.
DUST COLLECTION AT MOSS NO. 3. Mining Congr. J., 55(7):53-56, July 1969.

A scrubber testing program of several years duration followed a costly effort to obtain satisfactory performance from scrubbers installed when Clinchfield Coal Company's Moss No. 3 preparation plant was built. The dryers have mechanical dust collectors, which have performed at approximately 94 percent collection efficiency, for recovery of dust. The exhaust fans, moving 64,000 cfm discharged to atmosphere with a solids loading of 3 to 3.5 gr/cu ft. Two impingement type, liquid scrubbing units per dryer which were included in the original installation never operated satisfactorily. A Turbulaire conical scrubber has proven most satisfactory of the several types tested and is now in use. Some of the problems encountered in this installation are discussed. The equipment now in use would be able to comply with any emission standard now in effect.

110 APTIC NUMBER 16695

Jones, William P.
DEVELOPMENT OF THE VENTURI SCRUBBER. Ind. Eng. Chem., 41(11): 2424-2427, Nov. 1949. 4 refs.

The practical application of the venturi scrubber to the removal of dusts, mists, fumes, odors, and smoke from gas streams is discussed. Factors affecting the scrubbing efficiency of a venturi are the velocity of the gas in the throat, the ratio of liquid to gas, and the distribution of liquid in the throat. Of these variables the first two have an appreciable effect on the pressure drop across the scrubber. Most of the power required for operation is expended in the gas pressure drop, which will vary with the amount of liquid used. In general, increased throat velocity results in higher scrubbing efficiency with less liquid, and with somewhat less pressure drop and fan power. A commercial venturi unit at a pulp and paper mill is recovering 7-10 tons of sodium compounds per day from fumes containing particles from below 0.1 to 1.5 micron. Installations on open hearth steel furnaces are achieving 97-99% efficiencies in removing smoke particles from 0.05 to 0.33 micron. Pilot plant studies indicate that the venturi scrubber has a removal efficiency of 98-99.8% for sulfuric acid mists and a 99.9% efficiency for coarse dust from blast furnace gas.

111 APTIC NUMBER 17176

Juengten, H., K. Knoblauch, and M. Kruel
MOVING BED ADSORPTION REACTORS FOR DRY SEPARATION OF SO2 FROM DUST CONTAINING WASTE GASES. (Wanderschicht-Adsorptionsreaktoren zur trockenen SO2-Abscheidung aus staubhaltigen Abgasen). Text in German. Chem. Ing. Tech., 42(2):77-81, 1970. 4 refs. (Presented at the Arbeitssitzung des Ausschusses 'Technische Reaktionsfuehrung', Salzburg, Germany, March 19, 1969.)

It is advisable to use a moving layer of adsorbing coke for the removal of sulfur dioxide from dust-laden wate gases since, with this method, both pollutants can be removed simultaneously. The concentration of SO2 in waste gas that has been allowed to flow transversely through a moving bed reactor is calculated on the basis of laboratory measurements of the SO2 penetration in a fixed bed as a function of the layer thickness. The experiments in the fixed bed adsorber were conducted with an SO2 concentration of 0.1% by volume, a gas temperature of 120 C, and a residence time of the gas of 4 sec (referred to a layer thickness of 1 m). Transfer of the results measured in the fixed bed to the calculation of the efficiency of the moving bed reactor showed that the degree of desulfurization is determined by the residence time of the coke. Moreover, the coke abrasion in the moving bed is likewise a function of the residence time. At high dust concentrations in the waste gas, the coke residence time must be shorter to avoid congestion of the coke layer. A high dust concentration causes higher coke abrasion. At dust concentrations between 1500 mg/cu m and 1900 mg/cu m, residence times of 15 to 20 h proved to be the upper limit. The dust had been reduced to a residual concentration of 50 to 100 mg/cu m.

112 APTIC NUMBER 16758

Kalika, Peter W.
HOW WATER RECIRCULATION AND STEAM PLUMES INFLUENCE SCRUBBER DESIGN. Chem. Eng., 76(16):133-138, July 28, 1969. 3 refs.

Wet scrubbers which can provide effective particulate removal are superior in performance to mechanical collectors, and competitive in performance with electrostatic precipitators and fabric filters in many industrial situations. The extent to which steam plume formation and water recirculation practices are important factors in the design of wet scrubbing systems for application to high temperature processes is discussed. The cooling of the effluent gases from high temperature systems requires the evaporation of large quantities of water, and the humidity of the scrubbed and cooled gases is usually very high. Despite

plume suppression techniques either by means of additional process equipment or by adjusting scrubber performance, the plume will still be present under adverse atmospheric conditions. Regulations that propose to deal with plume opacity should include a specification of weather conditions under which steam plumes are acceptable thus providing the system designer with a rational basis for system selection. Recirculation of scrubbing water to the cooling sprays of high temperature systems has been shown to affect scrubbing performance. An example is given of the analysis of scrubber water recirculation to scrubber system performance. It is important that the designer weigh the costs of air pollution control against the costs of treating discarded water.

113 APTIC NUMBER 17250

Kato, Kazuo
STACK SMOKE CONTROL IN A LARGE-CAPACITY BOILER FURNACE. (Daiyoryo boira no haien boshi ni tsuite). Text in Japanese. Nenryo Oyobi Nensyo (Fuel and Combustion), 36(8):753-763, Aug. 1, 1969.

Some practical methods to reduce smoke dust from oil burning in a large-capacity boiler furnace at a thermal power plant were discussed. Apparently, the most attainable method was to control sulfur trioxide and acid smut generation by mixing some chemicals with heavy oil to promote burning and to denature generated sulfur dioxide by injection into the emission gas. A relationship exists between the amount of air supply and the generation of acid smut and SO3. An increased air supply is proportional to the increase of SO3 and decrease of acid smut. Therefore, the minimization of the air supply is serious in controlling acid smut generation. Factors influencing oil burning under a fixed amount of air for a large-capacity boiler are the distribution of a secondary air supply (open-width of second damper), the amount of circulating gas and the location of its inflow, the open width of a burner tilting and the pressure distinction between heavy oil pressure and aerosol vapor pressure. Other factors include heavy oil temperature and management of the burner chips. Additional procedures responding to these techniques indicate the necessity of a fixed dust collector, cleaning the chimney, adaptation of the sulfur dioxide removal instrument, and the promotion of stack smoke dispersion.

114 APTIC NUMBER 16726

Kazakova, E. A., B. I. Khiterer, and V. E. Bomshtein
PURIFICATION OF EXHAUST GASES FROM NITRIC ACID PLANTS. Brit. Chem. Eng., 14(5):667-668, May 1969.

The presence of unabsorbed nitrous gases in the tail gases from nitric acid plants created a serious pollution problem and efforts to deal with it have followed various lines. In this article a pilot plant that applies the principle of adsorption of the nitrogen oxides by a fluidized stream of silica gel particles is described. The pilot plant consisted of an adsorption column operating at 5.5 atm and a desorber operating at atmospheric pressure. In the adsorption column, fluidized silica gel flows counter-current to the gas stream. The NO is partly oxidized to NO2 and adsorbed on the silica gel. The adsorbent saturated with NO2 is withdrawn from the adsorber base and passes to the desorption column. Here the adsorbent is heated with steam to 180 to 190 C while a current of air desorbs the silica gel. The desorption products, after dedusting in a cyclone are returned to the process.

115 APTIC NUMBER 17320

Keapner, Stanley K., E. W. Seiler, and Donald E. Bowman
PERFORMANCE OF COMMERCIALLY AVAILABLE EQUIPMENT IN SCRUBBING HYDROGEN CHLORIDE GAS. J. Air Pollution Control Assoc., 20(3): 139-143, March 1970.

Six commercial fume scrubbers were tested for their ability to remove hydrogen chloride gas from plating room exhaust air. The scrubbers, which represent different types of equipment available for this application, were chosen on the basis of their specified ability to remove 90% of the contaminant from a 2500 scfm gas stream consisting of ambient air with 20 mg/cu m of HCl gas. The units were connected to ductwork and piping simulating actual producting conditions. The contaminant was carefully metered into an accurately measured air stream drawn through the scrubber. A continuous sample of the scrubber discharge was recorded by a conductivity meter. The results are presented in a series of curves plotting efficiency vs water rate. Efficiencies of close to 100% were obtained with a vertical packed scrubber and extended surface scrubber. A horizontal packed scrubber and a plate scrubber attained efficiencies of better that 95%. A fan type scrubber was entirely unacceptable and is not recommended for use with a gaseous contaminant. The tests also revealed that optimum efficiencies can be obtained at water rates much lower than those recommended by the manufacturers. This makes it practical to use nonrecirculated water in production scrubbers. Variations in scrubber design and effectiveness of mist eliminators are also discussed. (Author abstract modified)

116 APTIC NUMBER 16962

Kielback, A. W.
THE DEVELOPMENT OF FLOATING-BED SCRUBBERS. Chem. Eng. Progr. Symp. Ser., 57(35):51-54, 1961. 6 refs.

Aluminum is produced by the electrolysis of alumina dissolved in an electrolyte consisting of cryolite and other fluoride salts. The reduction process is carried out in cells called pots. During operation of the pots, fluoride-bearing fume, gaseous hydrogen fluoride, carbon oxides, sulfur dioxide, and particulate matter such as alumina, carbon, and tar are released from the pots. Containment of these materials has been a problem in wet scrubbers with grids or other fixed packing and impingement surfaces because the surfaces requiring the most wash receive the least. Cleaning problems are severe when the gas contains either tar particles or tar-coated solids. Floating-bed scrubbers eliminate these problems by virtue of a self-cleaning device. Gas is passed upward through a bed of light spheres, increasing liquid hold-up and sphere buoyancy. As a result, the spheres are free for rotational movement and for movement in relation to each other. High gas turbulence is set up in the bed when the upward flowing gas

contacts the descending liquor. The effect is intimate mixing of gas and liquor to promote a hard scrubbing action. About 95% removal of fluorides at pressure drops of 3 1/2 to 4 in. water gauge was obtained in pilot studies of scrubbers containing polyethylene spheres. Other proven application of the floating-bed scrubber are treatment of aluminum-fluoride converter tail gas to remove silicon tetrafluoride and treatment of magnesium chlorinator tail gas to remove silicon tetrachloride.

117 APTIC NUMBER 16752

Kim, Byung C. and James E. Flinn
REACTION OF A PHOSPHATE ROCK WITH AN SO3-CONTAINING GAS MIXTURE TO MAKE SUPERPHOSPHATE. Ind. Eng. Chem. Process Design Develop., 8(3):401-407, July 1969. 4 refs.

Experimental research was conducted to investigate the reaction of SO3 in the presence of water vapor, obtained from a synthetic flue gas mixture, and phosphate rock, to obtain a high conversion of tricalcium phosphate into available P2O5 form, as well as efficient removal of SO3 from flue gas. The investigation was carried out in a fixed-bed reactor, employing Florida pebble rock. Investigations of effects of bed temperature, gas flow, SO3 concentration, and reaction time on SO3 pickup and conversion of P2O5 to available form showed that SO3 in flue gases can be removed by and reacted with phosphate rock to produce a product suggestive of fertilizer-grade normal superphosphate. About 87 percent conversion of total P2O5 present in the starting material to available form was achieved, yielding a product which contained 18.6 percent by weight of available P2O5. The experimental data were correlated empirically and presented graphically. Application of the data to reactor sizing is illustrated, using a moving-bed reactor as an example. (Author's Abstract)

118 APTIC NUMBER 17257

Kiyoura, Raisaku
STATUS OF AUTOMOBILE EXHAUST CONTROL IN THE WORLD. (Sekai ni okeru jidosha haikigasu taisaku no genjo). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 3(6):325-332, June 15, 1967. 13 refs.

The efforts of the United States, U.S.S.R., France, West Germany, and Japan to control automotive emissions were discussed. Goals aimed at in the United States are a 25% reduction in automotive emissions by 1975; 40% by 1985; development of a new engine type which will not emit exhaust gases by 1985; by 1990, mass production of the engine should be accomplished. A regulation for the fixing of waste gasoline reburning equipment with a blowby gas coupler to which partly burned gasoline leaking out of a crankcase goes back through the manifold of the engine was enacted in 1964. In 1966, motor vehicles were required to have an instrument to reduce carbon monoxide emissions by 50% (1.5% CO standard) and hydrocarbons by 65% (275 ppm standard). A regulation to reduce hydrocarbons to 180 ppm and CO to 1.0% in 1970's was planned as a third step. Very little air pollution from motor vehicles is found in Moscow, U.S.S.R., but many institutions are conducting research on an automobile exhaust gas purifier as the pollution problem increases in large cities. A regulation of exhaust emissions in France restricts CO emission during idling to below 4% and an effort is being directed to reduce CO by controlling the reciprocal idling regulator valve and throttle regulator valve to produce perfect burning. The beginning of automobile export to the United States prompted West Germany to start regulational actions. The problem in Japan is related to the traffic system in large cities where heavy traffic at intersections makes drivers repeatedly decelerate, idle and accelerate. Control methods undertaken by the Japanese which correspond to regulations in the United States were explained.

119 APTIC NUMBER 17004

Klimecek, Rostislav, Jaroslav Skrivanek, and Jan Bettelheim
STUDY ON DESULFURIZATION OF WASTE GASES. (Beitrag zur Entschwefelung von Rauchgasen). Text in German. Staub, Reinhaltung Luft, 26(5):235-238, June 1966. 7 refs.

To satisfy the future power requirements of Czechoslovakian industry in the coming decade, extensive use of lignite is necessary. Lignite contains 2% sulfur and waste gases contain 0.15 to 0.30% sulfur dioxide. The SO2 emission of a single steam power plant with a power output of 1000 MW is 100,000 tons/yr. The existing plan to build the required number of power plants of this capacity in the North Bohemian lignite region raises a very serious air pollution problem. The Research Institute for Inorganic Chemistry, evaluated the existing methods of SO2-removal from industrial waste gases with regard to their effectiveness and economic aspects. The most suitable SO2 removal method is one where SO2 is absorbed by aqueous solutions of ammonia or of ammonium bisulfite and which offer the possibility of producing saleable by products. So-called 'noncyclic' and 'cyclic' variants of these methods have been developed. A new design of the absorber tower for implementation of these methods incorporates 26 mm diameter helices wound of 3 mm diameter aluminum wires with a pitch of either 12 or 20 windings per 10 cm of height, which perform the same function as Raschig rings but are superior to them. The optimal helix dimensions were found by systematic empirical tests the results of three series of which are shown in three graphs.

120 APTIC NUMBER 17073

Koenig, Alfons
DEVICE FOR SUPPRESSING NOISE AND DUST IN VIBRATOR-OPERATED ROTARY TIPPLERS FOR CLEANING TRUCKS. (Laerm- und Staubbekaempfungseinrichtung fuer Foerderwagenreinigungswipper, die mit Vibratoren arbeiten). Text in German. Neue Huette, 14(12):756-757, Dec. 1969.

The carts in a mine are cleaned by rolling them on a tipper which vibrates heavily to loosen the adhering dust from the walls and by tipping them over to empty the dust. This procedure is noisy (112 db) and stirs a lot of dust. To reduce the noise, the entire tipper was encased by molded fiber boards. The casing is lifted up as soon as the vibrators are shut off. The space between the 5-mm walls is filled with glass fiber (1 mm), basalt wool (30 mm), and foam rubber (30 mm), followed by another layer of basalt

wool and glass fiber. The entire casing can be rapidly installed and removed. It is suspended on 8-mm ropes. Measurements of the noise level showed that it has been reduced to 90 db. An exhaust fan was installed in the center of the roof of the casing which draws off the dust through a 300-mm tube. In addition to improving working conditions, the equipment increased the cleaning rate from 80 cars per shift to 30 cars per hour. Reliability of the equipment after several months of operation was good and additional cleaners of the same type are planned.

121 APTIC NUMBER 17247

Kohayakawa, Takashi
ENGINE PERFORMANCE AND EXHAUST EMISSION CONTROL. (Enjin no kino kara mita jidosha haikigasu taisaku). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(7):411-420, July 15, 1968. 6 refs.

Technical difficulties in engine control devices were discussed. One difficulty is that manufacturers do not always take the user's convenience into account when concentrating on engine performance. It is widely realized that the air-fuel ratio is closely related to carbon monoxide exhaust emissions which can be reduced by perfect burning with a proportional increase of the air ratio, but it is also evident that the rarefied mixture results in a slow down of the engine performance. The problem of rarifying gas mixtures with air to reduce CO exhaust emissions without troubles in engine performance is divided into two aspects; one is related to the structural systems, such as the manifold, inhalation system, exhaust emission system, spark, and cooling; the other is concerned with system engineering and techniques to standardize quality and efficiency of the produced vehicles. The two organs in the manifold, the idling-slow organ which works at low load and the main organ, functioning at maximum load of acceleration, automatically alternate with each other. The alternation timing is the most difficult mechanism in the manifold and the rarefied gas mixture reinforces this difficulty which requires a design change and a highly elaborate manifold system efficiency. Exhaust emission control devices are not easily exploited and naturally increase the cost of vehicle production.

122 APTIC NUMBER 17119

Kriz, Milan and Josef Vejvoda
CONTRIBUTION TO THE DESULPHURIZATION OF FLUE GASES BY CALCIUM CARBONATE AT HIGH TEMPERATURES. (Prispevek k odsirovani kourovych plynu pri vysokych teplotach uhlicitanem vapenatym). Text in Czech. Prace Ustavu Vyzkum Paliv, vol. 15:106-128, 1967. 10 refs.

Flue gas desulfurization was accomplished by adding finely ground limestone to coal on a dry-bottom powdered-fuel-fired boiler with an 85 ton vapor/hour capacity. The absorption temperature range was 828-1117 C. The total content of SO2 in the flue gases that were not desulfurized was 744.2 kg SO2/hr. The efficiency of desulfurization was 38.8% with 38.2% excess limestone. Increasing the quantity of limestone did not improve efficiency. The product in the fly ash formed from the reaction between sulfur and limestone was identified as sulfur sulfate in 91% of the samples. The amount of fly ash produced with the addition of limestone was the same when limestone was not used. On the basis of the constant amount of fly ash, it was concluded that no deposits occurred in the combustion equipment or in the dust collectors from the addition of limestone. (Author summary modified)

123 APTIC NUMBER 17318

Kriz, Milan, Josef Vejvoda, and Bedrich Kedron
EMISSIONS FROM GAS PLANTS, COKING PLANTS, AND THERMAL POWER STATIONS AND MODERN METHODS OF THEIR LIQUIDATION. (Exhalace z plynaren, koksoven, tepelnych elektraren a moderni zpusoby jejich likvidace). Text in Czech. Ustav Vyzkum Paliv Monograph, no. 6, 156p., 1969.

Air pollution in Czechoslovakia as caused by gas plants, coking plants, and thermal power stations is studied. Future developments in these areas up to 1980 are indicated and appropriate control methods are suggested. The number of Lurgi gas plants, which are the major sources of town gas, are not expected to increase, though existing plants will intensify their operations. The present volume of coke production will remain unchanged to 1980. Enormous development is expected in the power station industry, the capacities of which will be designed for a brown coal with a high sulfur content. The study discusses dust generation in the Lurgi process and the most modern control methods used abroad. Desulfurization of waste gases from Lurgi plants is considered with special references to the waste gases from a recently installed Rectisol plant. In considering measures to improve the quality of air around coking plants, considerable attention is give to gas purification, tar separation and treatment with ammonia, and coke-oven gas secondary cooling. A method for the desulfurization of coke-oven waste gas by vacuum-soda is reported. A major part of the study is devoted to the problem of removing SO2 from thermal power plants. Promising dry desulfurization processes proposed for other countries, and Czechoslovak studies on the limestone process, are described. Electrofilters and other dust collecting systems for thermal plant fly ash are reviewed. Also considered is the problem of separating arsenic from the waste gas of one power station. Finally, provisions of the Czechoslovak Clean Air Act of 1967 are criticized. (Author summary modified)

124 APTIC NUMBER 13607

A STUDY OF AIR CLEANING FILTERS IN AN URBAN AREA WITH AIR POLLUTION. (Toshi kogai ni okeru kuki seijo sochi ni kansuru kenkyu.) Text in Japanese. KUKI SEIJO (Clean Air-J. Japan Air Cleaning Assoc.) (Tokyo), 6(5):6-56, Nov. 1968.

Air pollution caused by noxious gases was examined inside and out side a building in the center of Tokyo, where the air is severely polluted. The gases examined in this experiment were SO2, CO, and hydrocarbons. The efficiency of activated carbon filters removing these gases was evaluated. These filters replaced the high-efficiency air filters (HS type U8) which had previously been used in the heating and cooling system. The SO2 gas and odor inside the building were effectively absorbed by these filters, and sufficient data were obtained to design a ventilation system for these gases. The hydrocarbons and CO were not

effectively absorbed; furthermore, the CO concentration inside the building due to smoking was 10 ppm higher than that outside the building. It was therefore recommended that immediate steps be taken to remove CO gas from the building. Dust caused by smoking was analyzed spectrophotometrically and was estimated to be about 10-20% of the total. These data may be used in establishing programs to prevent air pollution.

125 APTIC NUMBER 17085

Lapple, C. E. and H. J. Kamack
PERFORMANCE OF WET DUST SCRUBBERS. Chem. Eng. Progr., 51(3):110-121, March 1955. 4 refs. (Presented at A.I. Ch.E. 46th Annual Meeting, St. Louis, Mo.)

Comparative performance characteristics were evaluated for many of the simpler contacting devices, the fundamental mechanisms which control the performance of a scrubber were determined. Aerosols were prepared by feeding dust at a uniform rate into a high-velocity air stream. The collection efficiency and pressure drop of various contacting devices when handling this dust-laden air were measured at various air flow rates, water flow rates, and dust loadings. Tests were first conducted on a laboratory scale and then repeated on a semiworks scale. The semiworks units were essentially geometrically similar to the laboratory units having 2.8 times the linear dimensions of the corresponding laboratory units. The types of devices evaluated and the dusts used are summarized in a table. In addition, exploratory tests were conducted to determine the effects on collection efficiency of using hot water and of injecting steam into the air stream. The bag filter was used for dust-loss measurements. Four dusts were used in the study: Talc A, Talc B, titanium dioxide pigment, and ilmenite. Electron micrographs of the ilmenite and Talc B dusts are given; a comparison of the pressure drop data for the laboratory and semiworks units is tabulated. The effect of dust concentration efficiency is shown. Any scrubber is basically capable of giving any desired collection efficiency. The required collection efficiency will determine the power requirement for a given unit.

126 APTIC NUMBER 17275

LaRue, Phillip G.
POLLUTION-CONTROLLED GAS INCINERATION: A SOLUTION TO THE GROWING PROBLEM OF SOLID WASTE DISPOSAL. ASHRAE (Am. Soc. Heating, Refrig. Aircond. Engrs. J.), 12(2):58-62, Feb. 1970. 4 refs.

Incineration of solid waste can be most effectively accomplished in a gas-fired multiple chamber incinerator. The incinerator is built to design criteria which allow adequate combustion chamber area, grate area, grate-to-burner design, and a method for remixing the off gases (from the primary combustion chamber) with additional air supply. The mixture is passed through a zone of flame at 1200 F or higher where secondary combustion takes place. In the secondary chamber, the time, temperature, and turbulence of combustion are utilized to complete the combustion of the off gases. The initial temperature and flame length necessary to reburn smoke, odor, and fly ash are created by an afterburner. A modern gas incinerator should be capable of passing the most stringent incinerator codes now in effect. On larger commercial industrial units, a gas washer or electrostatic precipitator may be necessary. In a gas washer, the gases and fly ash are trapped and passed through the unit where they are mixed with water to trap and settle out the particulate matter from the gas steam. With such a device, emissions are controlled to a point well below most acceptable limits.

127 APTIC NUMBER 15627

Litvinov, A. T.
FINE PURIFICATION OF GAS IN CASING SLEEVE FILTERS. (Tonkaya ochistka gaza v karkasnykh rukavnykh fil'trakh). Text in Russian. Elek. Sta., no. 10:42-44, 1969. 2 refs.

Experimental studies showed that fine removal of highly dispersed particles to a residual concentration of 0.006-0.008 g/cu m under normal conditions can be accomplished in casing sleeve filters at 190-215 C using glass cloth sleeves. Removal efficiency under these conditions reaches 99.5-99.9%. When filtration temperature is lowered, the residual dust concentration increases to 0.029-0.050 g/cu m under normal conditions, while the removal efficiency is decreased to 99.4-99.7%. Regeneration of the filter fabric is accomplished by reverse blowing at a rate of 0.01 to 0.05 cu m/sq m-sec. This method of dust removal permits purification at higher hydraulic resistances and filtration rates without danger to the strength or filtering properties of the fabric. The results presented are suitable for the design of air purification systems for central pulverized-coal plants.

128 APTIC NUMBER 16988

Litvinov, A. T.
ON THE HYDRAULIC RESISTANCE AND THE EFFECTIVENESS OF OPERATION OF THE TURBULENCE SCRUBBER. (O gidravlicheskom soprotivlenii i effektivnosti deystviya turbulentnogo promyvatelya). Text in Russian. Khim. Prom. (Moscow), no. 8:64-69, 1966. 19 refs.

Analytical expressions are derived for design calculations of the flow resistance and the effectiveness of cyclone scrubbers with throat entry of the scrubbing liquid. The flow resistance of such a scrubber is the sum of energy losses of the streaming fluid in overcoming the flow resistance associated with the reduction of the cross-sectional area at the throat and with the pressure of droplets of the liquid, as well as in dissipating the kinetic energy of the liquid stream and in its atomization. The expression uses the dimensionless flow-resistance coefficients associated, respectively, with the flow of gas only and with the injection of the liquid into the gas, the densities, respectively, of gas and water on entry into the throat, the specific consumption of the liquid, the gas velocity on entry into the throat, the velocity of the gas relative to the liquid droplets in the throat, and the liquid velocity on entry into the throat. The flow resistance in a scrubber when the droplets are caught by the cyclone is derived using the flow-resistance coefficient of the cyclone, the gas density on entry into the cyclone or on leaving the atomizer, and the gas velocity in the cylindrical section of the cyclone. The flow-resistance

coefficient may be calculated from an expression using the Reynolds number of the gas in the throat. The effectiveness of such a scrubber in removing solid particles from a gas given by an expression using the velocity of a droplet relative to the gas stream or a solid particle, the diameter of a fictitious tube equal to the mean diameter of a droplet, the diameter of a solid particle and its density, the gas viscosity, and the kinematic viscosity of the gas. An agreement was observed between experimentally determined degrees of retention of solid particles and those calculated with the aid of the above expression.

129 APTIC NUMBER 17022

Lohs, Wolfgang
MANUFACTURE OF AEROSOLS AND SEPARATION OF ULTRAFINE DUSTS IN SPRAY WASHERS. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(2):43-48, Feb. 1969.

Fine and unltrafine dusts for scrubbing tower experiments were generated by compressed-air atomization of a 5 wt% sodium sulfate solution with subsequent drying. The solution was led to an injector needle of an atomizer nozzle and passed through a swirl body with axial flow to a turbulence chamber tapering conically toward the nozzle mouth. The translational and rotational energy of the air was increased by the chamber shape. Maximum energy for atomizing a droplet was obtained by metering it through the atomization zone entrance through which air from the turbulence chamber excaped. When the separation of hydrophilic sodium sulfate and hydrophobic particles was tested in a spraying tower, fine particles were found to follow the flow line around the water droplet and to remain in the carrier gas. Only 10-50% separation efficiency was obtained with hydrophilic dust particles below 0.5 micron. Values for the separation of hydrophobic dusts were even lower. The separation of 0.3-0.5 micron particles was improved up to 60% by the condensation of vapors at the particles (nuclei condensation). The separation of the hydrophobic dusts was improved 20% by pretreatment with wetting agents.

130 APTIC NUMBER 16824

Malarkey, E. J. and C. Rudosky
WHAT CAN BE DONE ABOUT RECOVERY BOILER SNOWING. Paper Trade J., 153(28):58-60, July 14, 1969.

Many pulp mills find that they have a recovery boiler air-solids pollution control problem, even though the boilers are equipped with electrostatic precipitators guaranteed for collection efficiencies as high as 99%. The sporadic discharge of white flaky salt cake particles, or "snowing", occurs most often when normal changes in operating conditions cause or permit puffs of particulate discharge even from a precipitator of high average efficiency. Electrode rapping done to dislodge material from collecting electrodes, electrical sparking, and soot blowing are examples of points in the operation where puffs of salt cake particles can escape. Precipitators can be designed to eliminate snowing. Lower gas velocity, sectionalization of electric circuitry, and careful sequencing of electrode rapping elements are among the design elements that must be considered.

131 APTIC NUMBER 15827

Marks, G. W. and P. M. Ambrose
FIXATION OF SULPHUR FROM SMELTER SMOKE. DIETHYLENE TRIAMINE AND OTHER AMINES AS AGENTS FOR THE RECOVERY OF SULPHUR DIOXIDE PROGRESS REPORTS - METALLURGICAL DIVISION. 17. Bureau of Mines, Washington, D. C., RI-3339, p. 41-46,(3), May 1937. 5 refs.

Experiments are presented for using diethylene triamine solutions for recovering SO2 from smelter smoke; a cyclic apparatus was employed and consisted of a preheater and saturator for the gas stream, an absorption tower, and a reflux flask for liberating absorbed SO2. A bubble tower permitted a lower rate of circulation of liquid than a packed tower because it did not have the great surface to be kept wet at all times; it also removed any possibility of channeling, as occurred with the other type. In order to determine if a great quantity of SO2 could be recovered from a dilute air-sulfur dioxide mixture without excessive oxidation or serious loss of amine from solution, an intermittent run over a period of several days was performed, using a 15% aqueous solution of diethylene triamine in a cyclic apparatus with a packed tower. Only 1% of the SO2 absorbed was converted to amine sulfate. Analytical procedures for the determination of per cent sulfate and amine in amine solutions that contain SO2 are given.

132 APTIC NUMBER 15827

Marks, G. W. and P. M. Ambrose
PROGRESS REPORTS - METALLURGICAL DIVISION. 17. FIXATION OF SULPHUR FROM SMELTER SMOKE. DIETHYLENE TRIAMINE AND OTHER AMINES AS AGENTS FOR THE RECOVERY OF SULPHUR DIOXIDE. Bureau of Mines, Washington, D. C., RI-3339, p. 41-46,(3), May 1937. 5 refs.

Experiments are presented for using diethylene triamine solutions for recovering SO2 from smelter smoke; a cyclic apparatus was employed and consisted of a preheater and saturator for the gas stream, an absorption tower, and a reflux flask for liberating absorbed SO2. A bubble tower permitted a lower rate of circulation of liquid than a packed tower because it did not have the great surface to be kept wet at all times; it also removed any possibility of channeling, as occurred with the other type. In order to determine if a great quantity of SO2 could be recovered from a dilute air-sulfur dioxide mixture without excessive oxidation or serious loss of amine from solution, an intermittent run over a period of several days was performed, using a 15% aqueous solution of diethylene triamine in a cyclic apparatus with a packed tower. Only 1% of the SO2 absorbed was converted to amine sulfate. Analytical procedures for the determination of per cent sulfate and amine in amine solutions that contain SO2 are given.

133 APTIC NUMBER 17245

Masuda, Senichi
PERFORMANCE OF ELECTROSTATIC PRECIPITATOR AND ITS DESIGN

PRINCIPLES (II) --- PROBABILISTIC DESIGN OF ELECTROSTATIC PRECIPITATOR. (Denki shujin sochi no seino to sekkei jo no kangaekata (sono II) --- Denki shujin sochi ni okeru kakuritsu teki sekkei ho). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 1(5):343-347, Dec. 15, 1965. 1 ref.

The apparent velocity of moving dust, the performance determining factor of an electrostatic precipitator, is a probability variable, which is influenced by an infinite number of hidden variables. Its probability density function has a large measure of dispersion. In so far as the ordinary domain of its design is concerned, the performance function has quite a low parameter sensitivity. Therefore, what differs from the design of ordinary equipment is that it is economically impossible to design an electrostatic precipitator whose performance is fully guaranteed. It must be designed and guaranteed in terms of probabilities. As far as V is regarded as a probability variable, the only thing that can be said in reference to performance guarantee is that the electrostatic precipitator is designed to have a degree of confidence (P) so that the percentage of precipitating efficiency will be over a given quantity. Also, with respect to performance, the only possible statement is that an electrostatic precipitator should have the percentage of precipitating efficiency over 99% with the degree of confidence 90%. A graph and some equations were worked out from many experimental data of V on the same type of existing electrostatic precipitators. With these data, a new electrostatic precipitator can be designed in terms of probabilities, with its performance guaranteed also in terms of probabilities.

134 APTIC NUMBER 16934

Matrozov, V. I., V. M. Rama, and Z. V. Chagina
INVESTIGATION OF HIGH-SPEED UNIFLOW ATOMIZING SCRUBBERS DURING ABSORPTION OF READILY-SOLUBLE GASES. (Issledovaniye vysokoskorostnykh pryamotochnykh raspylitel'nykh apparatov pri absorbtsii khorosho rastvorimykh gazov). Text in Russian. Khim. Prom. (Moscow), no. 2:126,133, 1965. 15 refs.

The mass transfer coefficient and the flow resistance of the following were determined: four nozzle-free venturi absorbers, two variants of the ART absorber, and one venturi absorber incorporating an atomizer nozzle. In all tests, filtered air mixed with 0.5 to 1.0 volume % of NH3 from a cylinder and tap water as an absorbent were used. The consumption rates, G and L, in kg/sec of gas and liquid, their inlet temperatures, the NH3-concentration in the inlet and the outlet gas and that in the outlet water, as well as the pressure drop, delta P, in n/sq m, across the absorber were measured. The tests were made at specific mass rates of flow Wg of gas between 18 and 48 kg/sq m sec and at specific consumptions, m of water between 1 and 6 liters/cu m. The measured quantities were used to compute the number of transfer units, Ntu, referred to the NH3 concentration in air. The results are given in graphs showing the variation of Ntu and delta P (or delta P tube equals delta P - delta P pot, where delta P pot equals (1 + (L/G))p gamma g H, in n/sq m, is the pressure drop due to lifting the gas-water stream, the distance H, in m, the height of the vertically mounted venturi tube, p gamma in kg/cu m, the specific weight of gas with the ratio L/G, with m, or with h, in m, - the height of the absorption volume. In the nozzle-free venturi absorber the number of transfer units can be related to the L/G ratio by the expression: Ntu equals (0.993 + 40.7 Vtube) times ((L/G) to the 0.28 power) where Vtube, in cu m, is the effective absorption volume of the venturi tube, while the pressure drop across the venturi tube, delta Ptube, in n/sq m, can be related to that ratio by the expression: delta Ptube equals (270 + 8200 dth) ((L/G) to the (0.29 + 3.4dth) power), where dth, in m, is the throat diameter of the venturi tube. In the ART absorber, both in the one-stage and the two-stage variant, the number of transfer units is related to the water consumption by linear expressions. In the venturi absorber with an atomizer nozzle, the number of transfer units, is also linearly related to water consumption, but the constants A and B are different functions of gas flow than in the ART. Within the investigated range of values of m, the venturi absorber with an atomizer nozzle has the lowest pressure drop. However, its number of transfer units is smaller than in the nozzle-free venturi absorber, though slightly larger than that of the ART absorber. Its specific resistance, defined as the ratio delta P/Ntu is the lowest of all three types of absorbers.

135 APTIC NUMBER 17289

Matsumoto, Hiroyasu
REMOVAL OF SULFUR DIOXIDE FROM FLUE GAS THROUGH TURBULENT CONTACT ABSORBER. (Tahbyurento abuzohba ni yoru haien no datsuryuh). Text in Japanese. Netsu Kanri (Heat Management: Energy and Pollution Control), 22(1):22-29, Jan. 30, 1970.

The problems of sulfur dioxide pollution were solved by direct desulfurization of heavy oil and exhaust gases, and diffusion from tall chimneys. Absorption in an absorption column was described. The packed column and spray column which are usually used have many faults. Spray nozzles become clogged and their cleaning requires too much time. The apparatus becomes large for treating large quantities of gas and requires frequent maintenance. The inclination of flaw lowers the efficiency. A turbulent contact absorber solves the above problems. It has two grids at the upper and lower parts of the absorption column and light plastic balls are packed among them. Gas is blown from the lower nozzles and the absorbent is sprayed from the upper nozzles. The plastic balls move violently by the impaction force of the gas and liquid. The plastic balls are covered with new absorbent enabling them to absorb gas. The column does not become clogged because of the cleansing effect of the moving balls. The absorbent is usually an alkali solution or sea water. The desulfurization rate of this method is higher than 90% for 90,000 N cu m of exhaust gas per hour.

136 APTIC NUMBER 16937

Miczek, Gerhard
COMPARATIVE INVESTIGATIONS WITH CYCLONE SEPARATORS. (Vergleichende Untersuchungen an Zyklonentstaubern). Staub (Duesseldorf), 20(9): 39-43, Jan. 1960. 3 refs. Translated from German. 16p.

The total collection efficiencies were determined with the same dust but at various pressure losses, for the four cyclones Van Tongeren, Korsa, the cyclone with counter-current flow and vanes, and the cyclone with the helical plate covering. Measurements

were performed under the following conditions: the specific throughputs were constant, the maximum diameters of the whirling chambers were the same as the conical parts of the chambers, the total lengths of the cyclones were equal, and the settling chamber and the cyclone outlet into that chamber remained unchanged. Under those conditions, the collection efficiency was practically the same for all cyclones. A comparison of designs also showed that the investment costs are practically the same. The existing minor differences diminish still further when the costs for a series of collectors are considered, since all structural features including the dust feeder, the settling chamber, and the removal system can be constructed alike. Only the cyclone with the helical plates will be less expensive. The Van Tongeren cyclone requires slightly more space. As far as wear and tear is concerned, the small cyclones with tangential inlets are not particularly advantageous. The cyclone with vanes and counter-current flow offers a better resistance in this respect. The economy of cyclone separators, particularly with in-series designs, depends first and foremost on the specific throughput and the selected pressure loss and hardly on the design of the individual cyclone. (Author conclusions modified)

137 APTIC NUMBER 16960

Millar, Russell W. and Herbert P. A. Groll
REMOVAL OF SO2 FROM GASES. (Shell Development Co., San Francisco, Calif.) U. S. Pat. 2,139,375. 7p., Dec. 6, 1938. (Appl. June 14, 1937, 7 claims).

A method for the removal and recovery of sulfur dioxide from sulfur-containing acidic gases or liquids is described. Sulfur dioxide is extracted from a liquid or gaseous mixture by scrubbing with a liquid solvent composed of an ether, ester, or mixed ether-ester of a polyhydric alcohol derivative. The polyhydric alcohol derivative is liquid at room temperature and no molecule contains more than three directly linked carbon atoms devoid of oxygen atoms. The liquid solvent and sulfur dioxide mixture is then separated from the sulfur-containing acidic gas or liquid. Sulfur dioxide is recovered by heating or reducing the pressure of the mixture to expel it.

138 APTIC NUMBER 17187

Ministry of Transportation, Tokyo (Japan), Bureau of Automobiles
COUNTERMEASURE FOR THE EXHAUST GAS OF AUTOMOBILES UNDER OPERATING CONDITIONS. (Shiyokatei no jidosha nitaisuru haikigasu taisaku). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(2):7-9, Feb. 15, 1968.

Since September 1966, the allowable carbon monoxide emission from new automobiles has been limited to below three percent. This measure now covers 60% of the automobiles in large cities. To enable the standard to be met, design changes were introduced in combustion chambers, air intake, carburetor, and spark plug systems. Additionally, manufacturing facilities were modernized and quality control programs intensified. Seasonal inspection of all equipment is necessary to prevent any lowering of efficiency. In July 1968, the newly established Automotive Public Nuisance Department of the Research Laboratory for Naval Architecture began a study on the relation between engine conditions and exhaust gas composition. The effect of inspection and adjustment was investigated in 1230 automobiles. An institute for the traffic safety and public nuisance research is also being established. Based on results obtained by these groups, standard of inspection and adjustment for exhaust gas control devices will be enacted.

139 APTIC NUMBER 16825

Moody, Gene B.
MECHANICAL DESIGN OF A TALL STACK. Hydrocarbon Process., 48(9): 173-178, Sept. 1969. 6 refs.

The complete step-by-step mechanical and structural design details of a 200-foot high steel stack lined with a castable refractory are presented. The stack was designed for a refinery to deal with the sulfur plant tail gases (SO2 and H2S). The state air pollution control code required that particulate matter at ground level be limited to 0.25 ppm for SO2 and 0.06 ppm for H2S. The tail gases were mixed with flue gases from three boilers. Interesting aspects of the stack were its free-standing height and highly corrosive gas stream.

140 APTIC NUMBER 16941

Moore, Hugh K. and George A. Richter
METHOD AND APPARATUS FOR RECOVERING SULFUR DIOXIDE. (Brown Co., Berlin, N. H.) U. S. Pat. 1,315,189. 5p., Sept. 2, 1919. (Appl. Nov. 16, 1917, 19 claims).

A process is described in which the burner gases from a sulfur-burning furnace are dehydrated and then circulated through a refrigerated non-aqueous liquid absorbent which selectively absorbs sulfur dioxide from the mixed gases. The SO2-bearing liquid stream is then preliminarily heated and, on reaching the discharger, is further heated to about 100-150 C, thus liberating the SO2, collecting it, and if desired recovering it in liquid form. After leaving the discharger, the gas-free absorbent passes through a heat exchanger and a cooler for preliminary chilling, and is then delivered to the absorber again for refrigeration and for receiving a fresh charge of gas. Absorbents of unsaturated vegetable oils, especially those having relatively large proportions of the glycerids of the fatty acids lower in saturation than olein, such as soya bean and cottonseed oil, give the best results, but should be carefully dehydrated before use. Because the absorbent used is non-aqueous and because the gas is dehydrated, most of the apparatus described can be made of iron or other inexpensive materials instead of the lead or bronze in current use for the commercial handling of SO2. Besides these savings in construction and maintenance costs, by employing as the absorbent a liquid having a specific heat less than one, much smaller dischargers and heat exchangers can be used, thus providing significant savings in fuel consumption.

141 APTIC NUMBER 17213

Muermann, Herbert
FLUE-GAS DUST EXTRACTORS. (Rauchgasentstaubung). Text in German. Wasser Luft Betrieb, 13(12):460-463, Dec. 1969.

Mechanical centrifugal-type dust separators of different designs for installation in medium-size and small boiler plants are discussed. The basic elements of a centrifugal separator are explained. In the last few decades, the flow- and the separation- processes have been formulated analytically and studied experimentally, leading to improved designs. A further development was the use of several smaller centrifugal separators (so-called 'battery cyclones') or of a large number of very small centrifugal separators (so-called 'multiclones'). The individual separators, of which a battery cyclone is composed, are made in different sizes, such as 400, 450, 500, 560, and 630 mm in diameter, and with volume rates of flow between 1200 and 4000 cu m/hr. These units can be assembled to take care of any specified gas input rate, while requiring a smaller overall amount of space than the conventional designs. By installing a system of guide vanes in the outlet duct for the cleaned gas, the energy associated with the angular momentum of the outlet gas can be recovered, thus rendering the pressure drop across the battery separator quite low. The multiclone is a high-performance separator consisting of many small parallel tubes with stationary internal vanes which impress on the dust-bearing inlet gas a rotary motion, so that the dust is separated from the gas by centrifugal force. These tubes are more effective, suffer less abrasive wear, have a lower flow resistance than the larger units, and can be installed and removed individually in separate locations. Standard tube modules, each with its own dust bin, offer many operational and economical advantages.

142 APTIC NUMBER 17232

Nagasawa, Eiichi
PRESENT STATUS AND FUTURE PROSPECTS OF DESULFURIZATION IN R AND D PROJECTS OF JAPAN GOVERNMENT - REMOVAL OF SULFUR DIOXIDE FROM FLUE GASES AND FUEL OIL. (Ohgata purojekuto keikaku ni miru haigasu datsuryuh oyobi juhyu chokusetsu datsuryuh to sono shohraizoh). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 3(1): 19-28, Jan. 15, 1967.

The sulfur contained in crude oil is concentrated in heavy oil. As the result, the flue gas of heavy oil contains more sulfur dioxide than other oils. Measures for the control of sulfur dioxide are divided into desulfurization of flue gas and direct desulfurization of heavy oil. Flue gas desulfurization methods are in turn divided into dry and wet methods. Dry methods, exemplified by the activated coal and activated manganese oxide processes, offer more advantages than wet methods. In the activated coal process, flue gas is passed through a layer of activated coal and sulfur dioxide is adsorbed as sulfuric acid. The sulfuric acid is washed off by water as dilute sulfuric acid and the activated coal is dried. The goals of this method are 90% efficiency. In the activated manganese oxide process, flue gas is mixed with the powdered manganese oxide which combines with sulfur dioxide to form manganese sulfate. The manganese sulfate is collected by electrical dust collectors, and the flue gas is discharged from the chimney. Manganese sulfate reacts with ammonia to regenerate the activated manganese oxide and to generate ammonium sulfate as a by-product. The desulfurization rate of this method is higher than 90%. Direct desulfurizations of heavy oil has also been investigated. The costs of the above processes are listed.

143 APTIC NUMBER 15948

Nakano, Toshihiro
THE EXAMPLE OF ODOR CONTROL WITH OZONE. (Akushuh taisaku to shite no ozon riyo no jissari rei: Nagoya shi Horidome shorijoh ni okeru ichi rei). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(6):359-363, June 15, 1968. 6 refs.

Deodorant and ventilation facilities at a sewer treatment plant at Horidome, Nagoya city are described. The volume of air treated is 11,910 cubic meters. The air can be changed eight times an hour, since the ducts and ventilator handle 1600 cu m per min. Because the sewer odor is a mixture of many gases, its analysis is difficult. Among the principal ingredients are hydrogen sulfide, indole, skatole, and ammonia. Deodorizing methods considered were adsorption, absorption, masking, counteraction, combustion, autotrophy, and oxidation. Because of space limitations, the method of oxidation by ozone was chosen. The amount of ozone required is about 1 ppm, i.e., 1.75 mg per cu m air. Total ozone used is 168 gr per hour. The amount of raw material is 269 liters air per min, and the rate of ozone generation is 7.6 liters per min. Four seconds are required for the mixing of odor and ozone. The reaction takes place in the exhaust duct of the ozone generator. Operating costs of the process are 104,520 yen ($290) per year. Ammonia has decreased about 60 percent. Other components can not be measured because of their low concentration. Factors affecting the continuous operation of the ozone generator will be reported later.

144 APTIC NUMBER 17000

Neumann, G. H.
THE PRACTICE OF REMOVING DUST FROM AIR IN INDUSTRY WITH THE AID OF FILTER FABRICS. (Die Praxis der industriellen Luftentstaubung durch Filtergewebe). Text in German. Z. Ges. Textile Industrie, vol. 66:1010-1016, Dec. 1964. 4 refs.

Fundamental innovations in the development of fiber materials and weaves opened fresh opportunities of using dust extracting processes. Many of the new designs coming from filter-makers point unmistakably to the fact that the tendency to use fabric dust extractors is growing. The stringent cleanliness requirements which are to be anticipated of legislation can be met better and more economically in the lower temperature scale with good filter weaves than with many a wet or electric system. Various fields of application for fabric dust extractors, and new developments in the field of fully and semi-automatic cleaning were described. Materials capable of standing up to a considerable amount of heat and less expensive gas cooling methods enabled fabric dust extractors to gain a foothold in the hot gas cleaning sector, which five years ago was inconceivable. This applies particularly to the extraction of dust from smelting furnace gases by means of special filter materials, which were described in detail. (Author abstract modified)

145 APTIC NUMBER 16827

Newell, J. E.
MAKING SULPHUR FROM FLUE GAS. Chem. Eng. Progr., 65(8):62-66, Aug. 1969. 4 refs.

A research and design program for the study of the alkalized alumina process for removal of sulfur from stack gases was undertaken by the Central Electricity Generating Board (England). One of the objectives of the study was to consider designs which could be adopted as extensions to existing, large generating stations or other SO2 producing industrial plants. Alkalized alumina is used in a fluidized bed to react with SO2 in the flue gases. Reactant regeneration then proceeds in two main stages: reduction of sulphate to lower oxidation states and release of sulfur as H2S. The design factors and economic analysis are based on a typical electricity generating station with four 500 MW units, burning coal containing 2.3% sulfur as the source of the flue gases. Throughout the design study a sulfur loading of 5% on the reactant is assumed. The preliminary estimate of capital costs is 3 million pounds ($7.2 million). The plant is self contained apart from the supply of flue gas and the ultimate discharge into the stack and would therefore be suitable for other than power station sites provided the installation were large enough. The process, while still not fully established, offers substantial prospects for reducing pollution levels and for achieving the economic recovery of sulfur from waste gases.

146 APTIC NUMBER 16904

Nicklin, T. and B. N. Holland
FURTHER DEVELOPMENT IN THE STRETFORD PROCESS. Gas World Gas Coke, 158(4125):273-278, Sept. 7, 1963.

The Stretford process for the liquid purification of hydrogen sulfide in gas streams is a continuous operation that produces a pure form of sulfur. The development of the process from laboratory to plant scale is summarized, and measures taken to achieve atmospheric and higher pressures in plant operations are outlined. The effects of these conditions on side reactions are considered. In the Stretford process, initial absorption of hydrogen sulfide by alkaline solutions containing disulfonic acids and vanadate is followed by the oxidation of hydrosulfide with vanadium, the liberation of sulfur in the presence of oxygen, and the formation of reduced liquid disulfonic intermediates. The reduced liquid is reoxidized by air to regenerate the liquid. Since hyrosulfide is rapidly oxidized by vanadium in a washing tower, hydrogen sulfide does not reach the oxidizer and side reactions producing thiosulfate are virtually eliminated. Froth flotation of sulfur occur in the oxidizer, facilitating diversion of the froth to a settling tank prior to filtration. Sulfur is recovered as sulfide-free concentrated ammonia. The Stretford process removes hydrogen sulfide from fuel gases at 20 atm to statutory limits with about 0.6% oxygen or with a 25% excess of air. Estimated capital costs of a plant purifying 11 million cu ft of coal gas a day are less than $354,000; estimated operating costs are less than $29,000. The process also removes carbon dioxide, hydrocyanic acid, and lower mercaptans from gas streams.

147 APTIC NUMBER 17186

Niizu, Yasushi, Akira Yoshikawa, and Sadao Kubota
A STUDY OF THE FILTRATION OF SUBMICRON DUSTS. 4TH REPORT: A THEORETICAL ANALYSIS OF FILTRATION EFFICIENCY. (Sabumikuron jinai no roka nikansuru kenkyu. Dai 4 po Rokakoritsu no rironteki kaiseki). Text in Japanese. Kukichowa Eisei Kogaku (J. Japan Soc. Heating Air Conditioning Sanitary Engrs.), 43(9): 797-805, Sept. 25, 1969. 19 refs.

A theoretical analysis of the dust catching efficiency of a single fiber was performed and good agreement with experimental measurements was obtained. Using the assumptions that the dust particle is spherical; the filter fiber, cylindrical; the fiber surface, clean; that the particle adheres to the fiber surface; and that the electrostatic force is negligible, together with gravity and chemical reaction, an approximate solution of Oseen's equation of fluid motion was calculated by a large-scale computer. Effects of inertia and diffusion were taken into consideration when calculating the efficiency. The experiment was performed on a packed layer of filters, and the result was modified for a single fiber. The quantitative agreement between the theoretical and experimental calculations suggests that the dust collecting efficiency of the packed filter in practical use can be estimated with little error from the theoretical calculation of the diffusion and inertia. The tendency of the experimental value to exceed the theoretical one is attributed to the neglect of electrostatic effects and so forth. A study of those effects is currently in progress.

148 APTIC NUMBER 17203

Oels, Heinrich
AIR POLLUTION PROBLEMS IN WEST GERMANY AND THE ROLE OF INDUSTRY. (Luftforurensningsproblemer i Vest-Tyskland industriens innsats). Text in Norwegian. Tek. Ukeblad (Oslo), 116(45):1245-1247, Dec. 1969.

West Germany has been occupied in the last decade with reducing emissions of dust and smoke. Effectiveness of dust filters has increased threefold, and filtration is more economical. The dust content can now be reduced to 150 mg/cu m for an emission rate of 100,000 cu m/hr. In 1950, the dust output from the West German cement industry was 3.5% of the clinker produced; in 1967, it was 0.15%. Dust output from the manufacture of calcium carbide was reduced to 3 mg/cu m of exhaust gases. Attention now centers on reducing sulfur dioxide emissions. An electric power plant in Essen absorbs it with a new type of activated carbon, recovering the SO2 for the manufacture of H2SO4, the cost per 1000 kWh being about 1 DM (25 cents), and this can be further reduced. Government standards now limit the sulfur content of fuel oils to 1.8%. About 20% of the total SO2 emission in West Germany comes from sulfuric acid plants. A new 'double contact' process can reduce SO2 emissions of such a plant from 17 to 3 kg per ton of H2SO4 produced. Nitrogen oxides emitted from nitric acid plants have been reduced by 50% with special absorption equipment. New legislation sets a maximum average of 2 mg/cu m for fluorine emissions, or 5 mg for short intervals. Readings as high as 2.7 mg have been recorded above the Ruhr from January 1, 1966, to December 31, 1968. During that period, industry in

North Rhine-Westphalia invested 4,000,000,000 DM on air pollution problems related to existent operations and about 275,000,000 DM on those related to new ones. Exhaust purification for the 2-year period cost 3,000,000,000 DM, plus an additional 30,000,000 for research - this in comparison with a gross national product of 300,000,000,000 DM per year. The total amount spent by industry is small compared with the damage caused, which amounts to 50 DM per capita per year, or 3,000,000,000 for the entire republic, not including losses due to sickness or sanitation problems.

149 APTIC NUMBER 17177

HIGH SCORE IN AIR/WATER QUALITY SET BY AMERICAN CAN KRAFT MILL. Paper Trade J., 154(11):46:53, March 16, 1970.

A 300 ton per day kraft pulp and tissue mill in Oregon is an outstanding example of the use of advanced techniques for controlling air and water pollution. Notable success has been achieved in reducing kraft odor to a barely perceptible level, and the mill is meeting Oregon's stringent air and water quality standards. The mill is distinguished from other kraft mills by the absence of a direct contact evaporator in the recovery process. Instead, a three-stage, steam heated concentrator patterned after the conventional six effect Swenson evaporator raises black liquor solids to 62-65% for burning in the recovery furnace. The effect is to eliminate one point where odor formation occurs through contact of hot gases with the black liquor. Another variation from conventional design is the use of a dry bottom electrostatic precipitator. The unit, which eliminates another point of odor formation, is rated at 99.5% efficiency. Chemical and fiber losses throughout the mill are minimized and there are safeguards from accidental spills. Sumps are located on the effluents from the paper mill, pulping and bleaching recovery, lime kiln, and causticizing. The conductivity on each sump is measured and, if the minimum chemical content is exceeded, a pump automatically returns the flow to process. To keep production at the proper levels, and for air and water quality, control instrumentation at the mill is centralized. The approximate cost of the mill's air and water quality systems is $4 million.

150 APTIC NUMBER 16914

Pascal, Paul
PROCESS AND APPARATUS FOR THE MANUFACTURE OF LIQUID SULFUROUS ACID FROM DILUTE SULFUROUS ACID GAS. (La Manufacture de Produits Chimiques du Nord, Etablissements Kuhlmann, Paris, France) U. S. Pat. 1,398,791. 3p., Nov. 29, 1921. (Appl. Jan. 9, 1920, 4 claims).

Known processes for the manufacture of liquid sulfurous acid from dilute gases, in particular those derived from pyrite roasting, are costly, since extraction of the sulfurous acid anhydride entails considerable consumption of energy and a large plant. An improved process is based on the great solubility of sulfurous acid gas in nonanthracenic coal tar oils that are capable of dissolving one-fourth their weight at ordinary temperature when the sulfurous acid gas is at atmospheric pressure. Diluted gas is compressed, cooled to an ordinary temperature, and passed to a packed tower where it is absorbed by coal tar of very low volatility, preferably having a density equal to 1. The slight volatility of the coal tar makes it possible to extract the sulfurous acid by heating it in an expansion device. The separated sulfurous acid gas is then liquefied by compression, and the organic liquid returned to the absorption column.

151 APTIC NUMBER 17115

Punch, G.
GAS CLEANING IN THE IRON AND STEEL INDUSTRY. PART II: APPLICATIONS. In: Fume Arrestment. Iron and Steel Inst., London (England), SR-83, p. 10-23, 1963. 34 refs.

The choice of gas cleaning techniques for various steelmaking processes is reviewed. A dry collection system is judged most applicable for sinter plants, the particular one depending on specific plant needs. Fabric filter and dry plate precipitator methods are described for waste gases from open-hearth furnaces; some wet methods can also be used but involve corrosion and other problems. The high-energy scrubber and irrigated precipitator are the most obvious choices for deseaming process fumes, but they create secondary liquid effluent problems. Fume control from arc furnaces can be achieved by using roof-mounted close-fitting hoods or equipment for direct extraction from the furnace shell; furnace gases, once emitted, may be cleaned to 0.05 grains/cu ft by wet or dry precipitator, fabric filter, high-energy scrubber, or a combination scrubber-precipitator. Wet or dry methods are applicable to both the Kaldo and LD processes. A general summary is given of the effect of fluctuating operating conditions on collector performance, and the technical factors which must be considered in selecting appropriate gas cleaning methods are discussed in detail for each of the steel processes outlined above.

152 APTIC NUMBER 16731

Quig, Robert H.
NEW CONCEPT FOR CENTRAL RECOVERY OF SULFUR FROM INDUSTRIAL STACK GASES. Chemico World, 4(3):6-9, April 1969. 6 refs.

The electric utility, fossil fuel, chemical and other heavy industries are faced with an increasing problem in the control of sulfur dioxide emissions from their stacks. This article describes current methods of SO2 control and introduces an outlook for a new and commercially effective SO2 recovery system via the central process plant. Since most sulfur recovery systems appear to require large installations with high load factors to demonstrate economic returns, the smaller industrial plant is not in a position to recover stack gas. A venturi scrubbing system that could be installed on an existing steam plant would scrub SO2 and fly ash from stack gas using dolomite or lime as scrubbing agents. Using higher grade alkali materials such as sodium carbonate or magnesium oxide, this same scrubber could be used in the sulfur recovery system via the central process plant. Use of the central processing system will remove sulfur recovery activity with its concomitant capitalization and

operating costs from the industrial and utility companies.

153 APTIC NUMBER 16957

Bagatz, Edward G. and Donald E. McFaddin
SOLVENT RECOVERY. (Union Oil Co. of Calif., Los Angeles) U. S. Pat. 2,185,311. 9p., Jan. 2, 1940. (Appl. April 16, 1934, 14 claims).

A process and apparatus were invented for the recovery of sulfur dioxide and sulfur dioxide-benzene solvent treated oils. A solvent solution of sulfur dioxide, benzene, and water are separated into its components. First, the solution is vaporized. The vapors are then fractionated with liquid sulfur dioxide reflux which is free of benzene. This is done at a temperature and pressure which will condense all of the benzene and water vapors, but will allow the sulfur dioxide to remain uncondensed. This produces fractionated vapors of sulfur dioxide which are free of benzene and water. An intermediate reflux condensate with a high concentration of water is left. The bottom of the solution which contains benzene and is water-free is removed.

154 APTIC NUMBER 17152

Reid, G. E.
EXPERIENCE IN CLEANING BLAST FURNACE GAS WITH THE ORIFICE WASHER. Iron Steel Engr., 37(8):134-139, Aug. 1960. 2 refs.

The performance of orifice washers in cleaning blast furnace gas in a steel plant was evaluated. An orifice washer was first placed in service on a P-6 furnace which was equipped with a twin set of conventional tower scrubbers. The orifice, followed by a water separation tank, was installed in the vertical gas duct on the inlet side of each spray tower. Elaborate water spray piping arrangements are unnecessary. The important need is the continuous addition of spray water sufficient to wet and ensnare the dust. In a typical gas cleaning circuit, with the gas first being cleaned by the orifice washer and then being scrubbed by the spray tower, practically all dust removal is the result of orifice washer action. Results showed a clean gas loading of 0.03 grains per cu ft. This was nearly seven times better than that secured by the conventional method with a clean gas loading of 0.2 grains per cu ft. Similar results were obtained with the washer installed on a P-3 furnace. The installation required little maintenance, and only periodic cleaning of the orifice spray pipes. The orifice washer is relatively inexpensive to construct and is compatible with existing blast furnace facilities. A disadvantage to the system is the added pressure loss which requires about 3% more power to be developed by the furnace wind blowing prime movers. The cleaner gas means that a larger percentage of ore-bearing particles can be withdrawn from the gas stream and sent to the thickeners for reclaim, resulting in an increase in the production of sludge available for sintering. It was estimated that the increase in the recovery of metallics resulting from greater sludge production averages about 3%. The abatement of atmospheric dust discharge coupled with other operational gains made possible by the system, secured enthusiastic endorsement of the use of the orifice washer for cleaning blast furnace gas.

155 APTIC NUMBER 16646

Rengstorff, George W. P.
ROLE OF METHANE AND OTHER FACTORS IN CONTROLLING EMISSIONS FROM STEELMAKING PROCESS. Open Hearth Proc., vol. 46:438-456, 1963. 5 refs.

Smoke evolution in a 50-lb steelmaking furnace was successfully suppressed in laboratory experiments by injections of 4-15% methane, premixed with oxygen, introduced through a water-cooled lance. The amount of methane required appears to depend on jet velocity, characteristics of the flow of metal under the lance, and other dynamic conditions that have not yet been fully identified. Four percent of methane was enough to suppress smoke completely at 2800 F; 6.7% was adequate to suppress smoke above 2820 F. At these temperatures, the addition of 10.3% methane suppressed smoke to 2550 F. Complete suppression at 2600 F required about 7% of methane. It is hypothesized that the effect of methane might result from driving hydrogen into the metal. Evolution of this hydrogen into the fraction of an inch above the metal surface that is critical to smoke formation might either prevent formation of FeO or cause it to become more volatile, thus stopping the pumping of iron from the surface. Why the smoke rate is higher at low temperatures and more difficult to suppress is not understood.

156 APTIC NUMBER 16807

Roberson, James E.
EFFECT OF RECOVERY ODOR CONTROL ON A KRAFT MILL ENERGY BALANCE. Paper Trade J., 153(34):86-89, August 25, 1969. 2 refs.

In the U. S., kraft pulping accounts for approximately 75 percent of the total U. S. chemical pulp production. From an air emission standpoint, odor reduction is a significant consideration in the kraft process. The energy balances associated with various odor control systems are discussed. Since each mill situation is unique, capital cost, operating cost, and acceptable emission levels must all be considered before arriving at a total evaluation of a recovery odor control system. The energy costs discussed are based on new recovery and multiple effect evaporation installations and assume that the turbine generator condenser is not operating at minimum condensing load.

157 APTIC NUMBER 16749

Rolfe, T. J. K.
REFUSE INCINERATION. B.C.U.R.A. (Brit Coal Util. Res. Assoc.) Gaz., 33(2):28-31, Feb. 1969. 12 refs.

Incinerable wastes cover a wide spectrum of gaseous, liquid, and solid materials. The problems posed by the need to dispose of increasing quantities of refuse by incineration have been discussed in a number of papers. This is a review of the incineration problem particularly as it relates to house refuse.

158 APTIC NUMBER 16935

Boss, T. K. and A. J. Coombe
GAS ABSORPTION IN A MULTIPLE LIQUID-JET CONTACTOR. Trans. Inst. Chem. Engrs. (London), vol. 44:T160-T165, 1966. 16 refs.

The performance of an experimental plate tower with short jets was investigated by measuring the rate of absorption of carbon dioxide in water-glycerol solutions with viscosities from 2.42 to 39.30 lb/ft h. The plates were provided with shaped orifices and, to protect the jets from horizontal liquid currents, these were surrounded by brass rings. Splaying and wavering of the jets was avoided through the application of water-repellant coatings to the plates. Results showed that the liquid-jet contactor performed satisfactorily over a reasonably wide range of conditions. Consistent jet stability was attained for the solutions with viscosities above 9.90 lb/ft h; at most liquid rates, the jets of these solutions fell into pools without gas entrainment. However, at low liquid rates and correspondingly long jet lengths, the jets broke down and entrainment occurred. The absorption rate of a jet falling into a liquid pool was in close agreement with theoretical calculations, provided the jets were formed by an accurately shaped orifice under good conditions. Square-edged orifices produced unstable jets, as did higher-viscosity solutions at higher liquid rates and shorter jet lengths. In general, the liquid-jet contactor compared favorably with jet, jet-spray, and spray contactors. Unlike packed towers, the contactor's efficiency can not be impaired by liquid underwetting or gas recirculation.

159 APTIC NUMBER 16797

Sakol, Stanley L. and I. S. Shah
REMOVAL OF SULFUR DIOXIDE FROM CLAY KILN EXHAUST GASES. Chemico, New York, 11p., 1969.

In the ceramic industry, the various types of clays containing a considerable amount of sulfur when burned in the kiln, release oxides of sulfur into the atmosphere. It is desirable to reduce the concentration of oxides of sulfur to meet the present and future air quality regulations. The Chemico wet approach venturi scrubbing system can effectively reduce the sulfur dioxide concentration, using an alkaline scrubbing liquor. The operating and equipment cost for the scrubbing system to handle 10,000 ACFM flue gas are $14,250/year and $47,200, respectively.

160 APTIC NUMBER 17224

Sakol, Stanley L. and I. S. Shah
REMOVAL OF SULFUR DIOXIDE FROM CLAY KILN EXHAUST GASES. Am. Ceram. Soc. Bull., 49(3):317-319, March 1970. (Presented at the Fall Meeting of the American Ceramic Society, Structural Clay Products Division, Atlanta, Ga., Sept. 11-13, 1968, no. 6-S-68F.)

In the ceramic industry, the various types of clays used contain a considerable amount of sulfur. These clays, when burned in the kiln, release a considerable amount of sulfur dioxide to the atmosphere, along with water vapor, carbon dioxide, and carbon monoxide. Dust particles in the exhaust gases vary from submicron size to more than 40 micron. Sulfur dioxide is efficiently removed from the flue gases by scrubbing them with alkaline solutions or alkaline slurries in a venturi scrubber at gas velocities of 6000 to 7500 ft/min. A suitable venturi also provides for the simultaneous collection of dust. Because the average amount of sulfur dioxide recovered is only 200 lb/hr, it is not economically feasible to regenerate the sulfur dioxide or the alkali.

161 APTIC NUMBER 17089

Sargent, Gorden D.
DUST COLLECTION EQUIPMENT. Chem. Eng., 76(2):130-150, Jan. 27, 1969. 55 refs.

The many different dust collectors available today are summarized in tabular form. Descriptions, illustrations, and efficiency curves of various collectors are given. Performance of the different types of collectors can be roughly compared by means of the curves showing grade or fractional-size efficiency. Some collectors described are: dry inertial collectors, louver type collectors, cyclones, multiple cyclones, impingement collectors, gravity spray scrubbers, centrifugal scrubbers, packed bed scrubbers, dynamic wet scrubbers, jet scrubbers, venturi scrubbers, fabric filters, and electrostatic precipitators. To make a preliminary selection, only four basic items are required: dust loading, particle size, gas flow, and allowable emission rate. Sizing a proposed collector or checking the performance of installed equipment may require sampling and analysis to determine dust loading at the inlet and outlet. Or a sample may be needed for particle size determination. There are a variety of techniques which can be used, permitting a choice depending on convenience, cost, or accuracy. Overall collection efficiency can be calculated by using a collector efficiency curve in combination with the particle size distribution curve, provided that the method of particle size measurement is the same for both curves. Calculations are shown in tabular form for a high efficiency cyclone followed by an electrostatic precipitator.

162 APTIC NUMBER 17113

Schackmann, Heinrich
RECENT DEVELOPMENTS IN THE TREATMENT OF NON-FERROUS METAL-CONTAINING ROASTED SULFUR ORE. (Neuere Entwicklung bei der Aufarbeitung NE-Metallhaltiger Schwefelkiesabbraende). Z. Erzbergbau Metallhuettenwesen, 20(11):499-511, Nov. 1967. 35 refs. (Presented at the General Meeting of the Association of German Metal and Mining Industries, Salzburg, June 2, 1967.) Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 38p., June 11, 1969.

Four examples from the roasting process with chlorine demonstrate how the treatment on nonferrous ores has been changed to meet the demands of the metal industries. The percolating leach, the roasting process, the sulfur dioxide percolation, and the reduction of the Fe concentration in the waste water are discussed. The concentrations of elements remaining after roasting with chlorine are listed and discussed. The new method

of volatilization with chlorine, applied to non-ferrous residues poor in metal, is described. In addition, the results achieved by an experimental plant with a capacity of 100 tons/day is discussed. Numerous charts on statistics, flow charts of various systems, and illustrations are given.

163 APTIC NUMBER 16730

Sebastian, F. P., A. F. Ariey, and B. B. Garretson
MODERN REFUSE INCINERATION. Mech. Eng., 91(4):27-32, April 1969.

A new generation of refuse incinerators has made West Germany the leader in the technology of solid waste disposal. A plant constructed at Dusseldorf to serve a 61.1 sq. mi metropolitan area with a population of over 698,000 has been designed to operate on unsegregated municipal refuse with an average colorific content of 2600 Btu/lb. In addition to reclaiming heat energy in the form of steam from the refuse, the burned-out residue is processed to recover ferrous metals and usable inert materials. The German air pollution code requirements are met through the use of electrostatic precipitators and a 100 m stack. Flue gases are carefully monitored. The Dusseldorf plant will have six incinerator/boiler units when completed. Total revenue will be about $3.40/tn of refuse, an amount which would suffice to meet all operating costs and allow for amortization of capital costs.

164 APTIC NUMBER 17068

Semrau, K. T., C. W. Marynowski, K. E. Lunde, and C. E. Lapple
INFLUENCE OF POWER INPUT ON EFFICIENCY OF DUST SCRUBBERS. Ind. Eng. Chem., 50(11):1615-1620, Nov. 1958. 21 refs.

The total power-input method of correlation as suggested by Lapple and Kamack has been applied to the following three types of pilot plant scrubbers: venturi, cyclonic spray, and pipeline. The procedure is described and supporting data are given. It is concluded that the venturi and cyclonic spray scrubbers and the combination of the two give substantially the same efficiency on a given aerosol when operated under comparable conditions at the same total power input (expressed as theoretical power input per unit of gas flow rate). The pipeline scrubber, using hot water, gives lower efficiency on recovery furnace fume than the other units. It is believed that this difference was due to condensation effects rather than equipment characteristics. This interpretation is supported by literature data. The venturi, cyclonic spray, and pipeline scrubbers gave comparable deficiencies on lime kiln dust and fume when operated at the same power input, but the precision of the data was not sufficient to reveal possible small differences in performance. Available literature data on efficiency of scrubbers on recovery furnace fume showed good agreement with data of this study.

165 APTIC NUMBER 16959

Serra, R.
INTERREACTIONS BETWEEN WATER VAPOR, ROOM TEMPERATURE, AND DUST IMPURITIES IN THE ATMOSPHERE DURING THE MEASUREMENT OF EXPIRATION GASES WITH THERMOCONDUCTIVITY-TYPE ANALYZERS. (Experienze sulle interreazioni fra vapor d'acqua, temperature ambiente e impurita del pulviscolo atmosferico durante le misure di gas espiratori con analizzatori rapidi a termoconduttivita). Text in Italian. Arch. E Maragliano Pathol. Clin., 24(5):597-606, Sept.-Oct. 1968. 4 refs.

Solution are described for dealing with problems relating to variations in the humidity and temperature of the atmosphere and the presence of dust, as these relate to measurements of exhaled gases with breath analyzers of the thermoconductivity type. The remedies include moistening the apparatus before use, providing a stopcock that is removable to allow cleaning of the needle, and the use of a diaphragm with a shunt system to regulate the flow of gases.

166 APTIC NUMBER 17032

Shultz, Forrest G. and John S. Berber
HYDROGEN SULFIDE REMOVAL FROM HOT PRODUCER GAS WITH SINTERED ABSORBENTS. J. Air Pollution Control Assoc., 20(2):93-96, Feb. 1970. 3 refs.

The Bureau of Mines prepared three sintered materials capable of removing hydrogen sulfide from producer gas at 1000-1500 F. They are mixtures of ferric oxide plus fly ash, pumice stone coated with fused ferric oxide, and sintered pellets of red and brown mud prepared from aluminum refining residues containing large amounts of ferric oxide. Mixtures of 75% fly, ash-25% ferric oxide gave absorption capacities ranging from 8.1% by weight of sulfur at 1000 to 42.7% at 1500 F. Pellets containing 40% pumice and 60% ferric oxide showed sulfur capacities of 23.3% at 1000 F to 30.6% at 1500 F. The most effective absorbent was a red mud whose absorption capacities ranged from 16.0% at 1000 F to 45.1% at 1500 F. Each absorbent was regenerated to an essentially fresh condition by passing air through the bed at 1000 to 1200 F. Sulfur dioxide was liberated and the reactive metallic oxides were reformed. During regeneration, small quantities of elemental sulfur and sulfuric acid were formed.

167 APTIC NUMBER 16836

Siegmund, C. W.
AIR POLLUTION: WILL DESULFURIZED FUEL OILS HELP. ASHRAE (Am. Soc. Heating, Refrig. Aircond. Engrs.) J., 11(4):29-33, April 1969. 3 refs.

The general effect of air quality regulations which limit fuel oil sulfur content will be a trend toward better fuel oils which will give fewer operating problems. The changes which occur will be similar whether the fuels are made from natural low sulfur crude or by desulfurizing higher sulfur content components. The fuels will be lower in viscosity, which means easier handling and better atomization. They will be lower in ash content so superheater deposit and corrosion problems will be minimized. They will tend to make fewer stack solids. The problems caused by SO_3, cold end corrosion and acid smuts formation, will be eased, but good combustion control will still be required. They may have higher pour points, but simple changes to storage

facilities will overcome any flow problems. It is expected that these fuels will be somewhat more expensive than current fuels due to additional processing costs or the cost of transporting fuel to an area not normally tributary to the source. However, a substantial part of the increased fuel costs may be compensated for by decreased operating costs as a result of the improved fuel quality.

168 APTIC NUMBER 16743

Skinner, Charles F.
NEW USE FOR BAGHOUSE FILTER: HANDLING HOT EFFLUENT. Plant Eng., 23(13):57-59, June 26, 1969.

Baghouse filtering systems can be successfully applied to processes emitting hot gases when temperature of gas stream is controlled and pre-cleaning is utilized. The air pollution problems encountered in a batching operation such as an asphalt mixing plant are described. A properly designed baghouse for use in such an operation will yield 90+% collection efficiency. Temperature and moisture control are important factors in design of the baghouse. By use of heat-resistant fabrics, temperature becomes less critical. Insulation and external heating must be sufficient to maintain the temperature of the baghouse above the dewpoint. Cloth area to air flow ratio is critical, and generally inefficient installations have been demonstrated to be undersized.

169 APTIC NUMBER 17107

Smith, William M., David Wheeler, Robert W. Olson, and David W. Coy
THE USE OF A FLOW MODEL IN THE DESIGN OF AN ELECTROSTATIC PRECIPITATOR. Blast Furnace Steel Plant, 55(12):1097-1102, Dec. 1967. 6 refs.

A flow model study was carried out to determine the devices needed in the ductwork of a gas cleaning system to achieve proper gas velocity distribution and substantial gas mixing, for application in controling the iron oxide emissions from open hearth furnaces. The submicron nature of the iron oxide fumes limits the selection of control equipment because high collection efficiences are needed for particle sizes of one micron and below; to obtain such high efficiencies, proper flow distribution through an electrostatic precipitator is just as critical as the original selection of the collection devices. The flow model was 1/16 scale, three dimensional, and constructed of clear plaiter; it included working models of the electrostatic precipitators, the inlet and outlet headers, and ductwork of the precipitators. The tests of velocity distribution and gas mixing run in the model are described. The results, which showed that proper gas mixing and distribution can be obtained in a system by means of internal baffles, distribution plates, and turning vanes without major modification to the system arrangement or duct geometry, played an essential role in achieving high collection efficiencies in the actual installation. Tests on the fully-operating precipitators were conducted at times when the inlet grain loading would be at a maximum, i.e., both furnaces at hot metal addition through lineboil. All the tests made showed that the outlet dust concentration was below 0.10 grains per cubic foot at standard conditions.

170 APTIC NUMBER 16776

Snowdon, P. N. and M. A. Ryan
SULPHURIC ACID CONDENSATON FROM FLUE GASES CONTAINING SULPHUR OXIDES. J. Inst. Fuel, 42(34):188-189, May 1969. 17 refs.

In one proposed method for removing sulfur oxides from flue gases, catalytic conversion of SO2 to SO3 is followed by controlled condensation of sulfuric acid. Previous work on acid condensation in this system has shown some divergences between the results of different authors. Recently published vapour pressure data for H2O, SO3, and H2SO4, above aqueous solutions of sulfuric acid, claimed to be more extensive and more accurate than those available hitherto, have made possible the construction of a general condensation chart with the co-ordinates of gas phase H2SO4 and H2O partial pressures. The chart shows the gas saturation temperature and the acid condensate strength and is not restricted to any fixed total pressure. (Author's Abstract)

171 APTIC NUMBER 17256

Soejima, Umio and Koichi Yoshida
THE SITUATION ON MOTOR VEHICLE EXHAUST EMISSIONS AND EFFECT OF CONTROL DEVICES. (Jidosha haikigasu no genjo to sono gensho taisaku). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(2):85-92, Feb. 1966. 17 refs.

The most influential aspect in reducing the automotive exhaust emissions is related to control of the air-fuel ratio and spark timing, since the carbon monoxide exhaust and hydrocarbon emission density varies in different vehicles. Automotive exhaust emission control should concentrate on development of control devices and technical advancement. A four mode drive test pattern conducted to measure CO and hydrocarbon emissions with an infrared analyzer. Average density of CO and hydrocarbon is 5.2% and 610 ppm when idling; 3% and 410 ppm during regular mode patterns; 3% and 500 ppm, during acceleration; and 3.5% and 490 ppm during deceleration. Hydrocarbon emissions tend to increase as spark timing develops while CO emissions do not have a specific relationship to spark timing, except when idling. This means controlling hydrocarbon emissions, 20 and 30% and more than 10% of horse power may be sacrificed. The air-fuel ratio for gasoline fuel should be 14.8 in purely theoretical terms. Carbon monoxide emissions show a remarkable decrease when the air-fuel ratio remains between 10 and 15, regardless of the engine system. If the air-fuel ratio in the manifold can be kept low, CO emissions can be remarkably reduced. Manifold air injection, slow throttle return, vacuum control throttle opener, and idle fuel shut off devices were also noted to be feasible.

172 APTIC NUMBER 17118

Speer, E. B.
OPERATION OF ELECTOSTATIC PRECIPITATORS ON O.H. FURNACES AT FAIRLESS WORKS. In: Air and Water Pollution in the Iron and Steel Industry. Iron and Steel Inst., London (England), SP-6,

p. 67-74, 1958.

Information on the electrostatic precipitators on 330-ton open-hearth furnaces in a steel company is presented. The furnace system is discussed to indicate the scope of the dust-cleaning problem with respect to volumes, pressures, and temperatures. Modern instrumentation enables the operator to accomplish the steelmaking process with good combustion efficiency and minimum furnace damage. The precipitator is described by presenting the design features of the chamber, collecting electrode system, discharge electrode insulators, electrical supply units, and safety devices. Dust collection from the precipitator hoppers is performed by a vacuum system with hoppers, piping, primary and secondary collectors, scrubber, exhauster, storage bin, and pug mill. Problems and solutions after four years of operation are discussed. Design conditions of inlet loading, draught losses, outlet loading, and efficiency are stated. The testing procedure used to check precipitator performance and the test results obtained are explained. The most serious problems encountered have resulted from gas-velocity increase and boil-period concentrated loading. Recent and anticipated improvements of major importance to decrease outlet loading by 100% are described as a result of data obtained to date. Various flow diagrams and illustrations are given. (Author abstract modified)

173 APTIC NUMBER 17084

Squires, B. J.
FABRIC FILTER DUST COLLECTORS. Chem. Process Eng., 43(4):156-159, April 1962.

Particle size analysis of the dust to be collected is extremely important in choosing fabric filter dust collectors. Gas volume, dust concentration, temperature, chemical analysis, and space available are other items that have an important bearing on the final selection. Comparative efficiency figures for a range of typical dust collectors readily available today are given. One laboratory method in use which gives a good guide to the best fabric; design data are illustrated. The development of special silicone-treated fiberglass cloth has enabled plants to operate well above the dewpoint of the highly corrosive gases and has become very economical. In the most modern plants, the gases leaving the furnace are cooled from 2000 to 600 F by water sprays and then passed through cyclone pre-collectors before passing to an automatic high-temperature fabric filter, using special silicone treated fiberglass filter tubes. The high-temperature filter operates continuously for long periods at temperatures of approximately 480 F and generally a lifetime of one to two years is obtained on 24-hr/day plants. One of the main reasons why fabric filters have such a high collecting efficiency is because the dust forms a porous cake on the surface of the fabric through which dust-laden gas or air must pass. The collection of the fine particles of dust is consequently effected in the porous cake of the dust itself and not in the fabric.

174 APTIC NUMBER 17049

Stairmand, C. J.
SELECTION OF GAS CLEANING EQUIPMENT: A STUDY OF BASIC CONCEPTS. Filtration Separation (Purley), 7(1):53-63, Jan.-Feb. 1970. 6 refs. (Presented at the Filtration Society's Conference on Choosing the Right Equipment for Dust Control and Air Cleaning at the Dust Control and Air Cleaning Exhibition, London, Sept. 23-25.)

In order to make a satisfactory choice of gas-cleaning equipment, information is needed about the dust and its carrier fluid and about the basic mechanism of operation of the available equipment. Some of the factors which must be taken into account are discussed and some of the methods by which the choice can be narrowed to a few pieces of equipment are suggested, such as economics, space requirements, reliability needed, and the expected working life of the process which the equipment serves. The performance of 18 varieties of dust-arrestor at three different particle sizes is given. The table will enable a preliminary selection to be made in terms of the fineness of the dust to be treated. The method of making the preliminary choice is illustrated. The most important criteria are the temperature and composition of the carrying gas and the general behavior of the dust in respect to stickiness, toxicity, and flammability. Where the dust-arrestment plant is to clean a process gas rather than to control an effluent, the permissible dust content of the cleaned gas may be influenced by the equipment which takes the gas after cleaning, and this may have a profound influence on the economics of the cleaning process, since down-time for maintenance of the machinery may be very costly in terms of loss of production. Space requirement, availability, and choosing proprietary equipment are also discussed.

175 APTIC NUMBER 16998

Stairmand, C. J.
SOME INDUSTRIAL PROBLEMS OF AEROSOL POLLUTION. Proc. Roy. Soc. (London), Ser. A, 307(1489):209-214, Oct. 1968. 4 refs.

Technical problems associated with the removal of submicron particles are discussed. These particles can be removed effectively only at great expense, either because the required equipment is large and costly, as for example electrofilters, or because high-energy consumption is involved, as in venturi scrubbers. Estimated costs of 99.9% removal of submicron particles from a typical gas flow are about $600,000 per yr. The main problem is that the forces acting on the particles are very small, so they move very slowly relative to the gas stream which carries them. Possible solutions are to increase the effective size of the particles by coagulation or condensation, or to impart greater acceleration to the particles. Coagulation proceeds so slowly under natural kinetic forces that it is unlikely to have practical applications. Growth by condensation of water vapor proceeds more rapidly but would require an excessive amount of steam. Achieving effective acceleration by the application of electrostatic forces appears attractive, but the appropriate technology has not yet been developed. At the present time, accelerated-impact scrubbers in which the scrubbing liquid is atomized by the dusty gas offer the best hope for removing micron and submicron particles from industrial effluents.

176 APTIC NUMBER 17054

Starkman, E. S., H. F. Sawyer, R. Carr, G. Johnson, and L. Huzio
ALTERNATIVE FUELS FOR CONTROL OF ENGINE EMISSION. J. Air Pollution Control Assoc., 20(2):87-92, Feb. 1970. 16 refs.

The possibility of reducing carbon monoxide and nitric oxide emissions through modifications of spark ignition engine fuel composition was investigated theoretically and experimentally. Ammonia, alcohols, hydrogen, reformed hexane, and a few representative hydrocarbons were considered. Calculations of exhaust gas composition and the influence of composition on equilibrium peak cycles were based on ideal Otto cycle processes. The agreement between predicted and measured exhaust concentrations was good in the case of chemically correct mixtures. At leaner or richer mixtures, there was considerable divergence. The results show that carbon monoxide and nitric oxide concentrations are profoundly influenced by fuel composition, with the production of the pollutants determined equally by carbon to hydrogen ratio and fuel energy content. Predictions of relatively lower nitric oxide concentrations with ammonia were not confirmed. It is suggested that the nitric oxide produced by ammonia combustion is largely a consequence of oxidative pyrolysis. This is unlike the case with hydrocarbons, where the nitric oxide is formed by thermodynamic equilibrium.

177 APTIC NUMBER 16777

Starkman, Ernest S.
ELIMINATING EXHAUST CO AND NO - IT'S POSSIBLE. S.A.E. (Soc. Automot. Engrs.) J., 77(7):28-29, July 1969.

Direct reaction between CO and NO, when mixed in equal amounts in the presence of a catalyst, produces N2 and CO2. In the combustion process of a spark ignition engine equal amounts of both gases can be supplied to the exhaust by burning a lean fuel mixture. This requires solving the problems associated with running an engine on lean mixtures, especially mixture control so that the maximum amount of time is spent at the CO-NO match point.

178 APTIC NUMBER 17251

Sugawara, Tuguyoshi
AUTOMOBILE EXHAUST CONTROL OF YOKOHAMA CITY AND IT'S OPINION. (Yokohama shi ni okeru jidosha haikigasu taisaku no keii to sono hyoka). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(11):713-719, Nov. 15, 1968.

Research on the influence of automotive exhaust emissions on the living body and a field survey conducted to obtain precise data on automotive exhaust emissions were reported. The survey covered spot measurements of exhaust emissions (carbon monoxide) on main roads, measurements on highways, and investigation of the interrelation of the components of exhaust emissions with other factors. The effects of emissions on growth, blood, pulse rate, learning ability, and pregnancy in rats were determined. Test results show little correlation between automotive exhaust emissions and living bodies. The result of a test to clean exhaust emissions by catalysis on a basis of a California Test Mode proved its effectiveness with a reduction rate of 78% the first time. One year later, the effectiveness was reduced to 30 to 40%. It was suggested that the cleaning rate is affected by the temperature of catalysis. If an 80% cleaning rate is expected, the temperature needs to be kept at more than 400 C. The catalytic exhaust emission gas cleaner was generally considered to have a wide adaptability to gaseous compounds and effectiveness under diversified drive patterns, although it is expensive. It also decreases in efficiency because of low temperature, noise and a decrease in horse power.

179 APTIC NUMBER 17265

Sugihara, Hiroshi
STEAM AUTOMOBILE APPEARING ON THE STAGE AS A COUNTERMEASURE AGAINST AIR POLLUTION. (Taiki osen taisaku to shite tojo shita jokijidosha). Text in Japanese. Nenryo Oyobi Nensyo (Fuel and Combustion), 36(8):795-800, Aug. 1, 1969. 1 ref.

Exhaust gas emitted by the internal combustion engine is a main source of air pollution in large cities. It is necessary for every automobile to be equipped with an emission control device, but it is not yet known when this will be achieved. Electric, gas turbine and steam automobiles are being produced as alternatives to the internal combustion engine. The electric automobile is limited in its use, with its engine unsuitable for the automobile, except in special cases. The gas turbine is also reported to be unsuitable for the automobile. The steam automobile produced on a trial basis by Steam Automobile Research in Rochester is not different in form from the conventional automobile of 120 hp. The merits of the steam automobile, whose top speed is 96 km per hr, are that is moves smoothly, is simple to handle, requires no gasoline, and requires only half speed of revolution. In addition, there is little loss of energy and chemical stability is good at high temperatures. Shortcomings of the steam automobile are that it freezes in winter, antifreeze decomposes at high temperatures (400 C - 500 C), it takes time to start, it requires removal of water condensed in the cylinder, and it increases in weight per hp. There is also the difficulty of steam cutoff and the danger of explosion. A report from Australia says that the car goes 10 km per one liter of fuel. Automobile manufacturers in the U. S. A. are wrestling seriously with this problem. Toxic components of conventional automobile exhaust are also described.

180 APTIC NUMBER 17246

Sumida, Yutaka
STATUS OF AUTOMOBILE EXHAUST CONTROL IN THE WORLD. (Jidosha haikigasu taisaku no jitsuho ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(1): 25-28, Jan. 15, 1968.

Motor vehicle regulations for exhaust emissions are found only in the United States and Japan. The European nations, England, West Germany, and France are in a process of discussion. Each country has a different drive mode test to determine emission standards. The United States has a seven mode test and Japan has a 4 mode test; in the European nations, a very complicated mode test was adapted. It is evident that automotive exhaust emissions can be reduced by controlling the air-fuel ratio which carbon monoxide exhaust emissions are dependent on since CO is generated from

imperfect burning. The revision of present engine design which can adjust rarified gas mixtures is of basic importance in an effort to promote equality of fuel distribution and fuel aerification. Vehicles with engine systems designed on the basis of fuel economics during partial load (regular speed) and concentrating on horse power increase during total load (acceleration) were studied. Exhaust hydrocarbon emissions can be reduced by application of this same theory. Several methods were presented for exhaust emission control, such as slow-up of the engine spark moment by improving the carburetor which would aerify an equalized mixture fuel, and installing an air pump, which promotes oxidation of partly burned liquid hydrocarbons.

181 APTIC NUMBER 17200

Suzuki, Masanao, Junichiro Wada, Tetsuro Kadowaki, and Kikuo Yamashita
DESULFURIZATION PLANT. (Datsuryu puranto). Text in Japanese. Kobe Seiko Giho (Kobe Steel Eng. Reprts.), 19(1):34-45, Jan. 1969. 3 refs.

Desulfurization of heavy oil by the hydrogenation and Stretford processes for hydrogen sulfide removal is reviewed. Of the indirect desulfurization methods, CRC VGO-isomax, HGO-unicracking, ESSO-hydrofining, and SHELL-tricle HDS processes are illustrated by flow charts, and examples of yields and material balances. Of the direct desulfurization methods, H-oil, UOP RCD-isomax, CRC RDS-isomax, and Gulf-HDS processes are described with flow charts, test results, and costs. The cost of desulfurization, estimated by the Ministry of International Trade and Industry, Bureau of Enterprise, is $2.83 per one kiloliter of heavy oil for the case where a sulfur concentration of 3.8% is reduced to 1%; the price of the recovered sulfur is assumed to be $36.11/ton. The importance of developing effective long-lived catalysts and the production of low-cost hydrogen is emphasized. The Stretford process was introduced in Japan in 1965; two plants are now using the process and another is under construction. The flow chart and practical examples of its operation are given. The importance of desulfurization in counteracting air pollution is stressed, and the need of a new process is emphasized.

182 APTIC NUMBER 17095

Swartz, J. H.
SULPHITE BLOW HEAT AND GAS RECOVERY. Pulp Paper Mag. Can. (Quebec), vol. 44:139-142, 1943. (Presented at the Annual Meeting of the Technical Section, Canadian Pulp and Paper Association, Montreal, Jan. 27-29, 1943.)

A system for the efficient recovery of sulfur dioxide and heat from sulfite digesters is described. Two stages are employed. In the first stage, the steam is condensed during the blow in a jet condenser, under conditions so that the condensing water leaves the condenser at a temperature of 190 F and then passes to the top of a hot water accumulator. The hot SO2-contaminated water, intermittently collected in the top of the accumulator, is continuously drawn away and passed through a heat exchanger. The cooled water is returned to the bottom of the accumulator. The cooled water provides the condensing water, which is returned to the jet condenser at the next blow. Cold, fresh water enters the heat exchanger at 60 F and leaves at 150 F. Since the water used for condensing purposes is employed in a closed system, and consequently is saturated with SO2, the SO2 in the blow steam is essentially not absorbed, but passes on to the second stage, or the SO2 accumulator system. During the blow, the water contained in the second accumulator is recirculated through an ejector. The cooled SO2 gas is absorbed in the water and used for make-up water in the Jenssen towers. The advantages of the system include relatively small pieces of heat exchange equipment and the use of a jet condenser with high heat absorption properties. Actual operating figures for a 10.7 ton digester showed a recovery of about 13,000 lbs of steam and 350 lbs of sulfur per blow. A larger portion of heat is recoverable by operating the blow pits similar to diffusers, the hot liquor being collected in a storage chest and pumped continuously through a heat exchanger. (Author abstract modified)

183 APTIC NUMBER 17189

Takanatsu, Takeichiro and Masaaki Naito
NUMERICAL CONTROL OF AIR POLLUTION. (Taikiosen no keisanki seigyo). Text in Japanese. Keisoku to Seigyo (Meas. Control), 8(12):841-846, Dec. 1969. 11 refs.

A theory of adaptive control of urban air pollution is proposed. A zone of complete mixing around a monitoring station is assumed. The pollutant concentration is uniform throughout the zone. Pollutants from various sources do not directly affect the concentration of the zone but change the concentration of air above the zone. The concentration of the zone is determined by a mass exchange due to the difference in concentration between the zone and the upper air. Based on this model, a control system is proposed to simulate the environment control. The operation of the system requires establishment of a criterion for optimum control. A quantitative expression for the damages caused by pollution is difficult to derive at the present time. It will be made possible, however, by future developments in system science. Los Angeles, Chicago, and Osaka utilize the approach described and New York City intends to adopt it. The cooperation of process engineers in the control of air pollution also is urged.

184 APTIC NUMBER 17238

Tanaka, Haruo, Masaru Tajima, and Yoshinobu Takahashi
A PRACTICAL EXAMPLE OF ODOR REMOVAL AT A CHEMICAL PLANT PROCESSING FISH AND SHELLS - OXIDATION OF ODOR SUBSTANCES BY AN OZONE PROCESS. (Gyokairui kasei kojo ni okeru joshu no jissairei - ozon ni yoru yuki seibun no sanka shori). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(5):321-329, June 15, 1966. 10 refs.

Results obtained with an ozone odor removal process are presented. At a fish - processing plant, an odor density of 110 had been halved by elutriation with river water. The river water itself contains some odorous substance. By adding ozone to the elutriation treatment, the original odor density was restricted

to less than 15. The maximum effect is achieved with 30 mg/cu m of ozone, the odor density declining even though there are some odorous substances left. If more than 30 mg/cu m ozone are used, an ozone odor is found in the emission gas. Therefore, the effective ozone supply for the original odor is thought to be 15 ppm in view of olfactory perception and atmospheric dilution. Problems associated with river water odor with respect to odor removal by elutriation can, in most cases, be resolved by the use of caustic soda, since few odorous compounds of river water are perceived by olfaction. In summer, when the pH density of the river water is higher than 5.8, neutralization by caustic soda can result in an alkaline odor remaining in the emission gas. The most ideal elutriation presented in this study indicates that 80% of the initial odor is washed by an acid liquid and the remaining 20% is purified by a weak alkaline liquid.

185 APTIC NUMBER 17097

Taylor, Gordon S. and Saul Rich
ANTIOZONANT-TREATED CLOTH PROTECTS TOBACCO FROM FLECK. Science, vol. 135:928, 1962. 2 refs.

Laboratory experiments protecting tobacco plants from ozone damage by the use of cloth treated with antiozonants were described. Tests showed that tobacco is protected by enclosing groups of plants completely in tents of cloth treated with 4,4'-dioctyl diphenylamine in butyl latex. The treated cloth also reduces the amount of fleck on adjacent, open plants. Spraying the antiozonant on the walls of a previously untreated tent prevents subsequent flecking of plants within the tent. (Author abstract modified)

186 APTIC NUMBER 17293

Terabe, Mototsugu
BAD SMELLS AND COUNTERMEASURES FOR THE PUBLIS NUISANCE. (Akushuh to kohgai taisaku). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 5(12):696-702, Dec. 25, 1969. 17 refs.

Most malodorous substances are organic substances containing nitrogen or sulfur, such as amines and mercaptans. Other malodorous substances containing no nitrogen and sulfur are phenols, cresols, butyric acid, and valeric acid. Industrial plants which possibly emit malodorous substances process paints, metals, plastics, oils, fats, petroleum refinery, and gum. Unpleasant odors are one of the most complex public nuisances. Odors are generated by many kinds and small quantities of substances, and the only measuring apparatus is man's nose. Katz classified the intensities of smells into five classes: zero is no odor; one, barely perceptable; two, faint; three, easily noticed; four, strong; and five very strong. The relationship of this scale to ppm with several sulfur compounds was studied. The intensity of smell did not directly correspond to the density. When the density became ten times, the intensity becomes about double. The degree of odor, odor unit, odor concentration and odor emission rate were explained. G. Leonardos measured odor thresholds of 57 chemicals. Deodorization methods were classified into absorption, adsorption, chemical oxidation, combustion, and neutralization. Deodorization methods having practical utility were explained. The adsorption method using activated coal is useful for alchols, acetic acid, butyric acid, caprylic acid, benzene, and mercaptans. Adsorption efficiencies of activated coal were tabulated for 97 substances. Removal of hydrogen sulfide was studied by many methods. The Takahax wet method, absorption by naphtoquinone sulfonic acid was noteworthy. Organic substances are removed efficiently by direct gas flame incineration.

187 APTIC NUMBER 16639

Terres, Ernst, Hanna Buscher and Georg Hatroff
A STUDY OF THE PROCESSES AND REACTION SPEEDS AT THE REGENERATION OF SCRUBBING LYES OF THE METAL THIONATE METHOD FOR REMOVING AMMONIA AND HYDROGEN SULFIDE FROM COKE GAS. A MANGANESE SULFATE PROCESS. IN MEMORIAM OF WALTHER FELD WHO DIED ON MARCH 15 1914. (Zur Kenntnis der Vorgaenge und der Reaktionsgeschwindigkeiten bei der Regeneration der Waschlaugen der Metallthionatverfahren zur Ammoniak-und Schwefelwasserstoff-Reinigung von Steinkohlengas. Ueber ein Mangansulfat-Verfahren. Zur Erinnerung an den Todestag von Walther Feld am 15. Maerz 1914). Text in German. Brennstoff-Chem. (Essen), 35(5/6):65-96, March 17, 1954. 10 refs.

The influence of sulfur dioxide in aqueous solution on the sulfides of iron and zinc was studied. The experiments were conducted isothermally at increasing SO2 concentrations and at various temperatures. The maximum concentration of the respective solutions had to be found which was in equilibrium with a salt of the initial material. The dissolution speed of the metal sulfides was measured alone and in the presence of ammonium salts. A study of the influence of aqueous SO2 on FeS showed a considerable dependence of the process and the end products on the SO2 concentration and on the reaction temperature. At each of the three temperatures of 20, 40 and 60 C, a different iron salt was obtained (iron tetrathionate, iron trithionate and iron thiosulfate which dissociates via iron polythionate to iron sulfate, SO2 and sulfur). At 20 and 40 C, FeSO3, FeS4O6 and FeS5O6 develop at various ratios depending on the SO2 concentration. At 60 C, only FeSO3 and little or no polythionate develops. The dissolution of FeS is rather slow; the NH3 and H2S of the coke gas accelerate this process and the entire dissolution is reduced to 1/12 of its time. Zinc sulfide is even more difficult to dissolve. Mainly zinc tetra thionate develops which dissociates to zinc sulfate, SO2, and elementary sulfur. Since the dissolution speed of ZnS in aqueous SO2 is so slow, the process cannot be used for the removal of NH3 and H2S.

188 APTIC NUMBER 16640

Terres, Ernst, Hanna Buscher and Georg Hatroff
A STUDY OF THE PROCESSES AND REACTION SPEEDS AT THE REGENERATION OF SCRUBBING LYES OF THE METAL THIONATE METHOD FOR REMOVING AMMONIA AND HYDROGEN SULFIDE FROM COKE GAS. A MANGANESE SULFATE PROCESS. (Zur Kenntnis der Vorgaenge und der Reactionsgeschwindigkeiten bei der Regeneration der Waschlaugen der Metallthionatverfahren zur Ammoniakund Schwefelwasserstoff-Reinigung von Steinkohlengas. Ueber ein Mangansulfat-Verfahren). Text in German. Brennstoff-Chem. (Essen), 35(9/10):144-151, 1954. 1 ref.

The formation of thiosulfate from (NH4)2SO3 plus S and from MnSO3 plus S alone and in the presence of (NH4)2SO3 or of (NH4)2S2O3 was studied. In neutral solution, MnSO3 can be converted to thiosulfate. The formation of thiosulfate is rapid in the presence of (NH4)2SO3 and even more so in the presence of (NH4)2S2O3. Simultaneously present (NH4)2SO3 is almost completely converted into thiosulfate without formation of manganese thiosulfate. After (NH4)2S2O3 has formed, a double reaction with MnSO3 occurs and the newly developed (NH4)2SO3 is converted to (NH4)2S2O3 if MnSO3(NH4)2SO3 is treated with elementary sulfur under water. A temperature increase speeds up all these reactions. The formation of several manganese-ammonium double salts was studied and the stable areas for MnS2O3/(NH4)2S2O3 were determined. Two double salts develop MnS2O3.3(NH4)2S2O3.3H2O and MnS2O3.(NH4)2S2O3.H2O. The latter is water soluble; MnSO3.(NH4)2SO3 is insoluble already at a concentration of less than 0.1% by weight of (NH4)2SO3 in the solution. The reaction of MnSO3 with ammonium polythionate in aqueous solution is fast; MnS2O3 and (NH4)2S3O6 are formed.

189 APTIC NUMBER 16729

Thoen, G. M. and G. G. DeHaas
RECOVERY FURNACES OPERATED WITH CONTINUOUS SULPHUR ANALYZER.
Paper Trade J., 153(19):61-62, May 12, 1969.

A continuous analyzer used for measurement of SO2 and reduced sulfur compounds was tested on a 350 tn/d black liquor furnace. The system had a sensitivity of better than 5 ppb of H2S based on 700 F flue gas analysis. It was found that steam and reduction of smelt were a first order function of reduced sulfur compounds in the flue gases. Some examples of adjustments made in the system are given.

190 APTIC NUMBER 16694

Todd, W. G. and Matthew Van Winkle
ENTRAINMENT AND PRESSURE DROP WITH JET TRAYS IN AN AIR-WATER SYSTEM. Ind. Eng. Chem. Process Design Develop., 6(1):95-101, Jan. 1967. 7 refs.

Jet trays can handle high liquid rates, but their use in absorption and distillation columns has been limited by their tendency to lose normal liquid inventories at some vapor and liquid rates. This occurs because of liquid jetting at the blow-off point. To determine conditions for optimum performance in a distillation column with small jet trays having 1/4 in. and 3/8 in. diameter holes, the effect of the following variables on entrainment and pressure drop was investigated: gas rate, 700 to 1750 lb/hr/sq ft; liquid rate 2900 to 30,000 lb/hr/ft of weir length; weir height, 0 to 3 in.; table angle, 45 and 60 deg; and tray spacing, 12 to 24 in. Increased liquid rates increased the tray pressure drop and the gas rate required for jetting, while increased tab diameter decreased the required gas rate. An increase in the tab angle decreased the effective horizontal momentum transfer of the gas with liquid, and tray pressure drops were smaller for 60 deg than for 45 deg trays. Weir height did not affect liquid inventory at higher gas rates, but decreased pressure drop. The try blow-off point and pressure drop were independent of tray spacing. Liquid bed height increased with increasing weir height, tab angle, liquid and gas rates, and decreased with increasing tab diameter. The entrainment data is graphically correlated with respect to liquid rate, gas rate, tab size, tab angle, and blow-off point. Fitted curves of the correlation of tray pressure drop at blow-off point and tray pressure drop for jetting liquid tray action will indicate if column operation is above or below the blow-off point, an important design parameter of the jet tray.

191 APTIC NUMBER 17033

Tompos, Endre
DISTRIBUTION TESTS OF PYRITE AIMED AT THE DESULPHURATION OF COKING BLENDS. (Kokszszen-keverekek kentelenitesere iranyulo pirit eloszlasi vizsgalatok). Text in Hungarian. Banyasz. Lapok., 102(12):815-820, Dec. 1969. 5 refs.

The content, output, form, and grain-size distribution of pyrite was studied during a petrographic investigation of coke. It was concluded that most of the pyrite remained in the coke, although it was present in small fractions of a specific weight intermingled with the petrographic components. About a quarter of the pyrite can be removed by sharp separation in a heavy suspension of 1.5 g/cu cm. (Author abstract modified)

192 APTIC NUMBER 17315

Tsujimoto, Tokuzo
AIR POLLUTION CONTROL IN U.S.A. (Amerika ni okeru taiki osen boshi). Text in Japanese. Netsu Kanri (Heat Management: Energy and Pollution Control), 21(12:4-9, Dec. 30, 1969.

The present state of air pollution in the United States is discussed, with emphasis on the trend of fuel consumption, characteristics of air pollution, photochemical smog in Los Angeles, smog control, state-sponsored research, pollution abatement in Pittsburgh, and air-pollution administration systems. Characteristically, 60.6% of the pollution in the United States is caused by motor vehicle exhaust gas. In Los Angeles, the precentage is as high as 90%. Because the crude oil produced in the States contains on the average less than 2% sulfur and imported heavy oil is also low in sulfur, the sulfur problem is not considered serious. The two major types of air pollution in the United States are photochemical smog, predominantly observed in Los Angeles, and smoke dust from coal burning. An effectual method of controlling photochemical smog does not exist, since it is a chemically oxidized phenomenon caused by interactions of NO and hydrocarbons with ultra-violet rays and ozone and influenced by geographical and meteorological features such as maritime inversions. Control of motor vehicle exhaust gas emissions, particularly NO and hydrocarbons, appears to be the only possible countermeasure. Studies currently underway at many institutions on motor vehicle exhaust gas in relation to photochemical smog are directed toward control of crankcase emissions. The striking reduction of smoke levels in Pittsburgh was made possible by the substitution of oil for coal, the use of electric dust collectors and bag filters by iron and steel factories and thermal plants, and the adaption of diesel engines by railroads and ships. Intensive monitoring of pollutants, penalties for violators

of emission standards, cooperation between research institutions, along with public support, are thought to contribute to air-pollution control.

193 APTIC NUMBER 17158

Uys, J. M. and J. W. Kirkpatrick
THE BENEFICIATION OF RAW MATERIALS IN THE STEEL INDUSTRY AND ITS EFFECT UPON AIR POLLUTION CONTROL. J. Air Pollution Control Assoc., 13(1):20-27, 32, Jan. 1963. 18 refs. (Presented at the 55th Annual Meeting of the Air Pollution Control Association, Chicago, Illinois, May 20-24, 1962.)

The use of beneficiated burdens in blast furnaces has increased during recent years and is expected to accelerate in the near future. Burden beneficiation is practiced through improving the physical nature of the raw material and through increasing the iron content of the charge. This has led to improved furnace performance, 'slips' have been reduced, dust rates, slag volumes, and coke rates have been decreased, and production rates increased. All these factors materially reduced possibilities of air pollution by the steel industry. (Author summary modified)

194 APTIC NUMBER 16958

Vaschetti, A.
THERMAL SULFURATION OF MINERAL OXIDES OF NONFERROUS METALS. (Solfurazione termica di minerali ossidati di metalli non ferrosi). Text in Italian. Met. Ital., 60(5):387-394, 1968. 13 refs.

A new procedure for the dry sulfuration of the mineral oxides of Zn, Pb, Cu, and Sn was studied. A mixture of sulfur dioxide and reducing gas (such as H2 or CO) reacts on the surfaces of the oxides of heavy metals at temperatures of 400-600 C, changing these to sulfides, which can be made subject to flotation with the usual sulfhydryl collectors. A test run of the method was made with a mineral oxide of zinc, using a fluid-bed reactor. Sulfuration occurred at high speed and gave a high yield. Sulfuration can occur directly on the surface of the material or by a secondary action of the intermediate products of reduction, when catalyzed by the sulfur dioxide. In the case of copper, iron, and lead oxides, there is a simultaneous reduction to lower oxides or to the metal itself, followed by direct reactions between these oxides and SO2. Zinc oxide is subject to flotation after treatment with xanthates. Limonite gangue is obstructive of this process because it is so easily sulfurized, but dolomite gangue does not react if the sulfuration is kept at moderate levels. The mixture of SO2 and reducing gases can be prepared by mixing sulfurous gases, derived from the roasting of sulfur, with reducing gases obtained by the gasification of solid fuels or mineral oils. If the solid or liquid fuels are high in sulfur, then these will also supply some of the desired SO2.

195 APTIC NUMBER 16647

Von Rosenblad, C.
HEAT AND SO2 RECOVERY WITH AND WITHOUT HEAT EXCHANGER. (Waermeund SO2-Rueckgewinnung mit und ohne Waermeaustauscher). Text in German. Zellstoff Papier, 19(4):205-209, April 1939.

The direct and indirect system of liquor preheating for the recovery of sulfur dioxide and heat in a sulfite cellulose plant is discussed. With the direct method, heating and concentrating the acid are carried out at the same time. The waste gases enter the cold acid immediately after cooking at low pressure without intermediate cooling. Large acid tanks are needed and the time for the final gas discharge is long. With the indirect method, the cold acid is concentrated with cooled waste gases and heated indirectly with the heat liberated by the final gas discharge from the digester. The advantage of this method is that no pressure must be applied and less SO2 gas is lost, since the cold acid absorbs more. The amount of heat liberated at the cooking is determined by the final temperature in the digester. If the latter is 132 C, the acid can be heated to 70 C. In case a higher acid temperature is desired, fresh steam must be added. A plant operating according to the latter principle is described and illustrated.

196 APTIC NUMBER 16778

Walling, John C.
AIR POLLUTION CONTROL SYSTEMS FOR THERMAL DRYERS. Coal Age, 74(9):74-79, Sept. 1969.

Historically, the dust control aspects of thermal coal drying have centered around product recovery with only secondary thought given to the air pollution control problem created by the material exhausted to the atmosphere. The trend of legislation is to eventually require the stacks venting thermal dryers to show no visible emission of coal dust. For coal dust fines, the dust emissions will be visible to the eye when the dust concentration exceeds 0.05 gr/cu ft of exhaust gas. The normal installation will consist of a thermal dryer, a primary collection cyclone, exhaust fan, and wet scrubber. The important factors in selection of these system components are discussed.

197 APTIC NUMBER 16842

Walther, James E. and Herman R. Amberg
A POSITIVE AIR QUALITY CONTROL PROGRAM AT A NEW KRAFT MILL. J. Air Pollution Control Assoc., 20(1):9-18, Jan. 1970. 3 refs.

In the design of the Crown Simpson bleached kraft mill at Fairhaven, California, the latest technological developments in odor and dust control were used to design a system capable of removing in excess of 90% of the malodorous sulfur emission and more than 98% of the dust load. The odor control system consists of high-efficiency black liquor oxidation, noncondensible gas burning, and stripping of "foul" condensate followed by burning of the off-gases. The dust control system on the recovery furnace consists of a high-efficiency electrostatic precipitator followed by wet scrubbers. The lime kiln gases are scrubbed in a Venturi scrubber and the smelt dissolver stack is equipped with demister pads. The gases from the lime kiln, power boiler, recovery furnace, and black liquor oxidizer are combined and discharged

through a 310-ft. stack. A complete emission inventory has been conducted and the volume, composition, and quantity of materials discharged are presented. (Author's Abstract)

198 APTIC NUMBER 17284

Watari, Shinjiro, Chuji Yuki, Yoshihisa Kato, and Hiroshi Kitagawa
PROPERTIES AND CHARACTERISTICS OF GLOBULAR ACTIVATED CHARCOAL. (Kyukei kasseitan no bussei to seino ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(4):192-201, July 1969.

Carbonaceous substances become activated charcoal by carbonization under suitable thermal conditions and by reactions with steam, carbon dioxide, air, etc. Activated charcoal has a larger internal surface area than the raw material, and is used as an adsorbent in industry. Lately, the use of granular activated charcoal has become important in the region of control methods for air and water pollution. For this purpose, the activated charcoal must have a large adsorption ability, mechanical intensity, stable quality, and low cost. The process for making globular activated charcoal having these properties was investigated. Activated charcoal had a higher desulfurization efficiency than the target value of desulfurization; a high yield rate of 57.4% was obtained. It had a composition of 81.4% carbon and 17.8% inorganic components. Vacant space comprised 49.5% and the internal surface area was 599 sq m/g. The adsorption ability for sulfur dioxide was 116 g/l. The process of desulfurization was clarified, but the relationship with the property of activated charcoal is obscure. The relationship of the internal surface area with sulfur dioxide adsorption efficiency is uncertain, but the oxygen content is strongly related to the sulfur dioxide adsorption ability.

199 APTIC NUMBER 17167

Weber, Ekkehard and G. Schmidt
MEETING AND EXHIBITION 'MAINTENANCE OF CLEAN AIR'. REPORT NO. 10 BY THE EXPERT PANEL ON EMISSIONS BY FOUNDRIES OF THE ASSOCIATION OF GERMAN FOUNDRY EXPERTS. (Kongress und Ausstellung 'Reinhaltung der Luft'. Bericht Nr. 10 des Fachausschusses Emissionen aus Giessereien im Verein Deutscher Giessereifachleute). Text in German. Giesserei (Duesseldorf), 57(2):30-41, Jan. 1970. 3 refs.

The second large exhibition and meeting 'Maintenance of Clean Air' was held from October 14 to 17 in Duesseldorf. About 2000 experts from 28 countries participated. Tremendous progress in the combat against air pollution could be reported. Between 1963 and 1968, the annual dust fall in the Ruhr area could be reduced from 312,000 tons to 251,000 tons, despite an expanding industry. Studies confirmed that about 35% of the pollution stems from industries; 45% comes from domestic heating; 20% comes from vehicles. The papers presented at the meeting ranged from discussions of European cooperation to combat air pollution, ways and aims of emission surveillance, prevention of air pollution by the traffic, sulfur dioxide emissions, the Grillo waste gas desulfurization method (based on chemisorption), the Bischoff and sulfacid methods, determination of emission concentration and the dispersion calculation, solid and gaseous air pollutants, practical experiences with dust collectors, and a discussion of special questions in the field of air pollution. Deflector separators, centrifugal collectors, wet scrubbers, cloth filters and electrostatic precipitators were shown at the exhibition. The deflector separator has hardly been used in practice because of its low efficiency. However, in connection with cyclones, they are well suited for waste gas cleaning. Of the numerous cyclones shown at the exhibition, the multi-cell collector for 4-t-cupola furnaces found special attention. It has a capacity of 9000 to 25,000 cu m/h(250 C). The dust concentration could be reduced to 0.78 kg/t. Glass fiber filters were dominant of the cloth filters, followed by polyester and polyamide fibers. Emphasis with the electrostatic precipitators was on the construction sturdier electrodes which are less prone to corrode.

200 APTIC NUMBER 13573

Whelan, P. F.
FINELY DISSEMINATED SULPHUR COMPOUNDS IN BRITISH COALS.
J. Inst. Fuel, 27(164):455-468, Sept. 1954. 5 refs.

Studies of the occurrence of S compounds in coal below 0.5 in. are described. Iron disulfide deposited simultaneously with coal matter has the marcasitic structure and exists in the mature coal as widely distributed grains about one micron in size, and concretions of up to 100 microns of marcasite heavily impregnated with coal. Iron disulfide is present in cleats and other cavities. Its crystal structure is that of pyrite and is considered to be of secondary origin. Froth flotation investigations showed that none of the specific depressant reagents for pyrite known to the mineral dressing industry effectively prevented the appearance of finely divided marcasite in clean coal froths. The degree of S contamination of the clean coal, however, can be controlled by careful adjustment of the frothing reagent quantity and by using lime in carefully controlled amounts.

201 APTIC NUMBER 16698

Whitney, Roy P., S. T. Han, and J. Lawlor Davis
ON THE MECHANISM OF SULPHUR DIOXIDE ABSORPTION IN AQUEOUS MEDIA. Tappi, 36(4):172-175, April 1953. 12 refs. (Presented at the 38th Annual Meeting of the Technical Association of the Pulp and Paper Industry, New York, N. Y., Feb. 16-19, 1953.)

The absorption of sulfur dioxide in packed towers is discussed in terms of the two-film theory according to which resistance to transfer is concentrated in a gas fluid film and a liquid fluid film in contact at the gas-liquid interface. The two phases are assumed to be in equilibrium; the equilibrium relation is the solubility of the gas in the liquid. It is shown that in systems pertinent to the pulp and paper industry, the absorption mechanism varies greatly with the character of the absorbent. Both film resistances play an important part in the sulfur dioxide-water system. In a sulfur dioxide-sodium carbonate solution where the stoichiometric ratio of absorbed sulfur dioxide to sodium carbonate is never more than 50 mole percent, the absorption rate is controlled by the gas film resistance. When the stoichiometric

ratio is increased to a maximum of 120%, liquid film resistance becomes important as conversion proceeds. In sodium bicarbonate and sodium sulfate solutions, the controlling resistance also shifts toward the liquid film. Also discussed are the coefficient values to be used in calculating the required packed height for three conversion stages: the conversion of hydroxide or carbonate to sulfite, the conversion of sulfite or bicarbonate to bisulfite, and the build-up of free sulfur dioxide.

202 APTIC NUMBER 16681

Willet, Howard P.
PROFIT ORIENTED SYSTEMS FOR POLLUTION CONTROL. American Institute of Chemical Engineers, New York, N. Y., American Inst. of Mining, Metallurgical, and Petroleum Engineers (AIME), New York, N. Y., American Society of Civil Engineers, New York, American Society of Heating, Refrigerating and Air Conditioning Engineers, New York, American Society of Mechanical Engineers, New York, and American Society for Testing and Materials, Philadelphia, Pa., Proc. MECAR Symp., Design and Operation for Air Pollution Control, New York, N. Y., 1968. p. 75-85. (Oct. 24).

The development of pollution control systems that provide an economically profitable return on control costs is described; it is believed that such processes will enhance control activities by establishing an economic incentive to add to the public pressures on polluters to install control equipment. Profit-oriented control systems are described for blast furnaces and the basic oxygen processes in steel fabrication, for foundry cupolas, kraft pulping, and for sulfur dioxide recovery from power and sulfuric acid plants. Venturi scrubbers, used to clean blast furnace gases, make it possible to obtain higher hot blast temperatures for preheating air blown into the furnaces and thus improve the economics of their operation. Gas take-offs installed below the charging door on foundry cupolas reduce the size of the gas cleaning equipment required and permit the gas to be used as fuel for preheating air blasts to the cupolas. A new method recently introduced from Japan, called the OG Process, has a great profit potential in its application to the basic oxygen process in steel-making, primarily by collecting carbon monoxide without combustion. A series of pollution control techniques can be applied to the kraft pulping process to reduce capital and operating costs. An absorption system to eliminate SO2 pollution from sulfuric acid plants and to increase plant profits is nearing completion, and a concept called the Central Processing Approach is described, involving the establishment of central processing plants, to permit the profitable recovery of elemental sulfur from the sulfur oxide emissions of both large and small power producers.

203 APTIC NUMBER 16815

Williams, David H., Jr., and John T. Dowd
DESIGN AND CONSTRUCTION FEATURES OF THE 1600 MW MITCHELL PLANT. Combustion, 41(2):19-23, August 1969.

Air and water pollution control were important considerations in the design of the 1600 MW Mitchell Plant of the American Electric Power Co. system. Thermal discharge problems were avoided by the use of cooling towers designed for a circulating water flow of 248,000 gpm with a 16 degree approach temperature and a 28 F range. The selection of the stack height was deeply studied. The stack for two 800 MW units would have to provide for the discharge and satisfactory diffusion of approximately 15,000,000 lb/hr of hot flue gas. At the discharge temperature of 300 F this represents about 4,700,000 cu ft/min. The basis for selection of a stack with a height of 1200 ft is discussed. Construction, scheduling, and control of the total plant is described.

204 APTIC NUMBER 16779

Winklepleck, R. G.
CONDITIONING AND WET CLEANING OF BOF EXHAUST GAS. Iron Steel Engr., 46(9):87-91, Sept. 1969.

The intense heat liberated by the BOF process requires a water cooled hood to burn and convey the gases. Useful steam can be generated in the hood. The greater absorption of heat in the hood reduces the size of the flues, wet gas clean-up and cooling tower requirements. In specifying and designing a system for handling the off-products from a BOF vessel, the complete system should be carefully studied to obtain the most economical and reliable selection of components which are all interrelated.

205 APTIC NUMBER 17233

Yanaki, Naoomi
AUTOMOBILE EXHAUST CONTROL AND RELATED GAS ANALYSIS. (Jidosha haiki gasu no johka narabini kanren bunseki hohhoh ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(2):100-108, Feb. 15, 1966. 2 refs.

Automobile emissions are divided into three categories: engine exhausts, crankcase emissions, and fuel evaporation. Among these, the most important is exhaust gas which contains the major part of carbon monoxide and nitrogen oxides. The principal ingredients of crankcase and evaporation emissions are hydrocarbons, the control of which is effected by the method of collecting and reburning. Air pollutants from automobiles are categorized as those due to incomplete combustion, those due to air intake, and those due to fuel components. The first category is reduced by complete combustion which increases the third category. Exhaust gas cleaning methods are grouped according to fuel modification, exhaust gas cleaners, and engine modification. To obtain complete combustion, afterburners are installed on exhaust pipes. Engine modification involves the redesign of air intake systems or the introduction of manifold air jets. Nitrogen oxides cannot be removed by the above methods. Of the two methods for their control, the most hopeful method is to recirculate exhaust gas to the intake air system. The removal efficiency of this method is above 80%. Hydrocarbons, carbon monoxide, and carbon dioxide are measured by infrared analysis, hydrogen flame ionization analysis, gas chromatography, etc. The phenol disulfonic acid method is standard for the analysis of nitrogen oxides, but unsuited to successive analysis. The optical analysis method is a potential successive method.

206 APTIC NUMBER 17262

Yanagihara, Shigeru
AIR POLLUTION AND FUTURE AUTOMOBILE ENGINES. (Kogai mondai to shorai no gendoki). Text in Japanese. Jidosha Gijutsu (Automobile Eng.), 23(11):1174-1183, 1969. 7 refs.

The prospects for reducing emissions from internal combustion engines or developing alternative engine systems are reviewed. Internal combustion engines, which include Otto, Diesel, and Brayton cycles, are divided into reciprocal and rotary types. The engines have 2 or 4 cycles or in the case of hybrid engine, a mixed cycle. Theoretically, the exhaust gas composition can be less than 25 ppm hydrocarbons, 0.25% carbon monoxide and 100 ppm nitric oxide. In practice, however, the minimum reduction attainable is twice as much, with control devices costing from $50 to $300. Replacement of the gasoline engine with other types of internal combustion engine is not realistic, and improvements in the control of exhaust gas are aimed at the present-day gasoline engine. Gas turbines emit fewer pollutants than other prime movers, but their use, especially for vehicles less than 200 hp, is rather limited. Steam engines and stirling cycles are remote alternatives; they will not replace gasoline engines in the near future. For the electric car, an alternating-current motor is promising. Advantages and disadvantages, of lead-acid, Na-S, and Li-Cl2 cells are discussed, together with a fuel cell of H2-O2, hydrocarbons, methanol, ammonia, or hydrazine. An energy-to-weight ratio of fuels is another important factor is considering future automobiles. Gasoline or kerosene have the best value. Hydrogen has a value of 1/2 the ratio of propane, even when used as a magnesium hybrid. In conclusion, improved exhaust-gas cleaning techniques are required for the internal combustion engine.

207 APTIC NUMBER 16999

York, Otto H. and Edward W. Poppele
WIRE MESH MIST ELIMINATORS. Chem. Eng. Progr., 59(6):45-50, June 1963. 13 refs.

Knitted wire mesh mist eliminators provide a low cost and efficient means of removing entrained liquid droplets from vapor and gas streams. Their installation in evaporators, scrubbers, and distillation columns up to 6-ft diameter requires only the addition of a support ring to hold the mist eliminator assembly. In larger vessels, intermediate supports are required in addition to the annular ring. As generally used, the wire mesh eliminator consists of a bed of fine diameter wires interlocked by a knitting operation to form a wire mesh pad with a free volume between 97 and 99%. For most applications, the pressure drop is negligible. An important development in the knitted mesh eliminators is the incorporation of a multifilament yarn into the basic wire mesh structure. Composite meshes have a demonstrated efficiency for the removal of droplets falling below the particle size range capabilities of the conventional wire meshes. Their advantages are realized in acid mist elimination from stacks, oil mist removal from compressed gases, and elimination of fine fog produced by the condensation of liquid from a saturated gas. The allowable velocity of the composite eliminator is approximately one-half of that for the wire mesh styles. Pressure drop is between 3 to 10 in. of water for most applications.

208 APTIC NUMBER 17021

Zebel, Guenter
AEROSOL DEPOSITION ON A SINGLE FIBER UNDER THE INFLUENCE OF ELECTRICAL FORCES. PART I. THEORY ALLOWING FOR DIFFUSION. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(2):21-27, Feb. 1969. 10 refs.

If the packing density of the fibers is sufficiently small, the separation of small particles in fibrous filters can be treated from the viewpoint of deposition on a single fiber. Eliminating the influence of inertia and settling of particles during precipitation on the fiber surface means that the effective separation mechanisms are Brownian motion (diffusion) and the spatial expansion of the aerosol particles. However, separation can be greatly improved by applying electrostatic fields to the filters. If the convection transport of particles toward the charged fiber surface is large compared to the diffusion transport, it is feasible to consider the theory of the diffusion boundary layer. The theory is particularly applicable when fiber diameters are about 10 micron and when flow velocities for particles larger than 0.000001 g are about 10 cm/s. The results of three different methods for solving the boundary layer equation are partially compared. Formulas are given for the deposition coefficient of single fiber for the limiting cases of respectively feeble and strong influences of the electrical forces.

209 APTIC NUMBER 17083

Aleksandrova, A. K.
METHOD OF INVESTIGATION OF THE DISPERSION OF AN ARTIFICIAL AEROSOL IN THE LAYER NEAR THE GROUND. (Metodika issledovaniya rasprostraneniya iskustvennogo aerozolya v prizemnom sloye). Text in Russian. In: A study of the boundary layer of the atmosphere from a 300-meter meteorological tower. Moscow, Akad. Nauk SSSR, 1963, p. 155-159. 2 refs.

Artificial luminescent aerosols of 3 different colors ejected simultaneously at rates that could be varied between 0.2 and 2.0 kg/min were used to determine the dispersion of aerosols emitted into the atmosphere by point sources located at different altitudes above the ground. The dispensers were mounted at 3 different heights and collections were made from those that were on the ground, placed in the direction of the wind at distances of up to 15 or 20 km from the tower. The samples were collected during and 1 to 2 hours after the ejection period on various configurations of 50 to 200 dust-collecting plywood tablets of 0.1 sq m area covered on one side with a tacky layer of a mixture of castor oil and colophony. The terrain within 20 km-radius from the tower contains large wooded areas and fields; the elevations vary 20 m on the average, the largest elevation difference being 50 m. This makes it possible to study the effects of the nature of the terrain cover on the process of dispersion of admixture in the air layer near the ground. The number of particles settled on the tablets was counted in ultraviolet illumination in the laboratory with unaided eye when the particles were larger than 45 micron in diameter. Otherwise, a special microscope was used with a drum for mounting the tacky tablet in the form of a cylinder to simplify its scanning.

210 APTIC NUMBER 17108

Aleksandrova, A. K.
USE OF EMULSION POLYMERS AS ARTIFICIAL AEROSOLS. (Ispolzovaniye emulsionnykh polimerov v kachestve iskustvennykh aerozoley). Text in Russian. In: A study of the boundary layer of the atmosphere from a 300-meter meteorological tower. Moscow, Akad. Nauk SSSR, 1963, p. 150-153. 10 refs.

Since 1957, the Institute of Applied Geophysics has been using emulsion polymethylmethacrylate powder as an artificial aerosol for investigating the atmosphere. This powder is produced industrially in large amounts by polymerization of an emulsion of methyl ether methacrylate in water with additions of a catalyst and an emulsifier. This plastic, known as Plexiglass, is insoluble in water and aliphatic hydrocarbons; impervious to acids and alkalis (except for concentrated nitric acid); swells and dissolves in alcohols, ketones and aromatic hydrocarbons; and softens at 50 to 70 C. The powder particles are spherical, transparent, and have a smooth, lustrous surface. Their specific gravity varies between 1.12 and 1.16, depending on the degree of polymerization. By sifting, the rather wide particle-size distribution of industrial powders, can be reduced to narrow particle-size bands. In their use as artificial aerosols, their detectability is of paramount importance. Besides the method of tagging with radioactive atoms, the method of utilizing luminescence under illumination by ultraviolet radiation for particle detection and determination of their dispersion has a sensitivity of plus or minus to the -10th power grams. The powder particles of polymethylmethacrylate are dyed superficially by luminescent dyes in a solution of ethyl alcohol under periodic stirring during 3 to 5 hours. For 1 kg of powder, 15 grams of dye and 1400 ml of alcohol are used, one part of which can be regenerated for reuse. The dyed powder is separated from the alcohol solution on a suction filter, rinsed with cold water until no dye is given off, and dried at not more than 45 C. The luminescence of the dyed powder does not diminish on exposure to sun light for a week. Of a large number of luminescent compounds tested, only 18 impart a bright luminescence to the powder. The name, chemical formula, pass-band and wave-length of the highest intensity of the emission spectrum as well as the color of the light emitted by these compounds is presented. For detection of luminescent particles, mercury-quartz arc lamps are commonly used.

211 APTIC NUMBER 17044

Amoore, John E.
PRIMARY ODOR CORRELATED WITH MOLECULAR SHAPE BY SCANNING COMPUTER. J. Soc. Cosmetic Chemists, 21(2):99-106, Feb. 4, 1970. 10 refs.

An experimental method is described for identifying and mapping out the chemical extent of the primary odor of isovaleric acid and its homologs and isomers (to which certain persons are specifically 'odor-blind'). The production of this primary odor requires the carboxylic acid functional group in conjunction with a limited range of molecular shapes and sizes. The odor was experimentally established by photographing a molecular isovaleric acid model in silhouette and using a pattern recognition machine to analyze the silhouette. The machine consists of a modified television camera linked directly to a computer. It scans the silhouette by means of a large, reproducible collection of random lines. The frequency with which each random line intersects the silhouette of a selected standard compound is compared with the frequencies observed for other molecular compounds. The degree of molecular similarity, assessed by 4096 random lines, is then printed out. As determined by primary odor measurements for 15 fatty acids, a strong correlation exists between molecular shape and odor quality.

212 APTIC NUMBER 17091

Andreatch, A. J., C. E. Fegraus, J. N. Pattison, and J. C. Elston
INSTRUMENTATION FOR NEW JERSEY'S VEHICLE EMISSION TESTING. ISA (Instr. Soc. Am.) Trans., 7(4):317-326, 1968. 3 refs. (Presented at the 14th National Symposium, Analysis Instrumentation Division, Instrument Society of America, Philadelphia, Pa., May 19-22, 1968.

An instrument evaluation program was conducted to determine the most suitable detectors for hydrocarbons, carbon monoxide, and carbon dioxide. Flame ionization was selected for hydrocarbon analysis and NDIR for CO and CO2 analysis. An analysis of the

individual modes and a composite bag sample was made. The mode analysis was desired in order to assist in the emission turn-up. The prototype will analyze for CO, CO2, and total hydrocarbons in exhaust emissions, and pressure or hydrocarbon concentration in blowby and smoke. The variable-dilution sampling system will allow an analysis to be made on a concentration or mass basis. The CO and hydrocarbon concentrations will be automatically corrected for CO2. A test procedure was developed so that an instrument could be evaluated in two days. The procedure included both laboratory and dynamometer testing. The laboratory evaluation was designed to determine the operating characteristics of the instruments. The major items tested were warm-up time, range of analysis, electronic noise, sampling calibration, response and recovery time, relative response to different hydrocarbons, interferent gases, hang-up time for gasoline standards, etc. If an instrument failed in the laboratory test, it was returned to the manufacturer for modification. For the second day of testing, raw exhaust was analyzed. A summary of various instruments evaluated and the cost of each is tabulated. A flow diagram of prototype instruments is given.

213 APTIC NUMBER 17029

Applebury, Terrill E. and Michael J. Schaer
ANALISIS OF KRAFT PULP MILL GASES BY PROCESS GAS CHROMATOGRAPHY. J. Air Pollution Control Assoc., 20(2):83-86, Feb. 1970. 4 refs.

An automatic process gas chromatograph was developed for use on the recovery furnace stack of a Kraft pulp mill. The instrument analyzes widely varying concentrations of hydrogen sulfide, sulfur dioxide, and methyl mercaptan, and higher order sulfur compounds. It is insensitive to the fixed gases and water vapor, and performs its analysis in approximately ten minutes. The instrument features a microcoulometric detector making it sensitive to H2S as low as 0.1 ppm, and SO2 and CH3SH as low as 0.5 ppm. The major limit to even higher sensitivity at this stage of development lies in two problems: the background noise level in the detector and the sulfur compound absorption in the Porapak Q chromatograph column. At the reported sensitivity, a 40-ml gas sample was used. The instrument also contains a data analysis system supplementary to the usual strip chart recorder. This system is made up of a digital voltmeter, a digital translator, and a teletype and hence allows the transfer of the output data to a digital computer for processing. The processed data are usually presented in the form of ppm quantities of the component gases in the stack gas. The instrument has worked successfully on small furnace effluent for periods of 25 hr but has not been tried on recovery furnace stacks. It was also run on prepared samples for periods of up to seven days with no maintenance or attendance necessary. (Author abstract modified)

214 APTIC NUMBER 16149

Arai, Kenya
THE OUTLINE OF ATMOSPHERIC TRACER FIELD TESTS IN THE WHOLE INVESTIGATION TO CONTROL INDUSTRIAL AIR POLLUTION. (Sangyo kogai sogo jizenchosa ni okeru ea-toresa jikken no gaiyo). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 3(3):150-156, March 15, 1967.

In Japan, atmospheric trace studies with fluorescent particles were first undertaken in the 1960's. In field tracer tests, special attention was given to determinations of wind direction and velocity, selection of test sites, and the location of test personnel, observation cars, and the communication system. Blowers were installed at heights of 105 to 192 m on power plant stacks in the survey area. The stacks were then sprayed and used as centers of fan-shaped sampling areas having angles of 40 to 90 deg and diameters of 10 to 15 km. Wind direction and velocity, air turbulence, temperature gradient, and the amount of sunshine were simultaneously observed. From these measurements graphs of diffusion distribution and stream line and charts of combined pollutant concentrations were obtained. Atmospheric tracer tests provide concentration distribution graphs for typical conditions of SO2 stack emissions. These distribution graphs are completed by comparison with measured sulfur dioxide at observation centers. Based on this data, instructions related to SO2 emission standards are issued to owners of plants or to local authorities by the Ministry of Industry and International Trade. Tracer studies also provide information for construction-site selection and city planning.

215 APTIC NUMBER 17288

Baba, Yoshio
MEASUREMENT OF MALODOROUS SUBSTANCES. (Akushu seibun no sokuteiho). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(4):179-191, July 1969. 34 refs.

Several problems exist in measuring malodorous substances in air, the largest of which is that susceptible limits of malodorous substances are very low. Usually the value is several figures lower than the measurable value. The concentration method was adopted in order to measure them. Water and carbon dioxide were removed before that concentration was determined. The concentration tube was cooled by liquid nitrogen. The apparatus and operation of this method was difficult; therefore, easy methods were proposed. The first method is absorption by an organic solvent such as acetone, methyl alchol, ethyl alchol, and ethyl benzene. The second method is adsorption by activated charcoal which is useful for hydrocarbons containing four to six carbons. The third is a glass filter method where malodorous gases are analyzed by gas chromatography. Chemical analysis was also used. The sample gas is passed through the absorption tube with specific reagents in it and analyzed by titration or by the colorimetric method. Functional measurements were also useful. There are three functional methods for measuring waste water odor: the ASTM method, the Japan Water Service Association method, and the saline solution method. There are several functional methods for measuring odors in air: the ASTM method, the Hader method, and the odorless room method. The gas detector method is easy and fast.

216 APTIC NUMBER 17117

Bevers, J. M. and F. C. Flack
DETERMINATION OF FLUORINE BY PROMPT (GAMMA)-RADIATION FROM PROTON BOMBARDMENT. PART I. THEORY AND EXPERIMENTAL METHOD.

Analyst (Cambridge), 94(1114):1-6, Jan. 1969. 19 refs. PART II. RESULTS. 94(1114):7-14, Jan. 1969. 5 refs.

The general principles governing the quantitative measurement of fluorine by proton bombardment are described. An expression for the limit of detection is derived; the importance of the stopping cross-section is discussed, and experimental arrangements are described. Part II presents the experimental results. The practical application of the nuclear reaction F(19) (p, alpha gamma) O(16) to fluorine determination is outlined. Analysis in liquid and gaseous phases suffers from the need to use a proton transmission foil; in principle, solids can be analyzed inside the accelerator vacuum, but powder targets are handled more easily by using a foil. Sulfur hexafluoride diluted with xenon was used in gas mixture studies. Fluorine in gases can be determined at relatively high levels (5-100%) by a simple system that could easily be adapted, by the use of thicker foils and higher bombarding energies, to reach much lower levels. Determinations in liquids were carried out in the range 20 ppm to 10% of fluorine in aqueous solutions. Interferences are not important, except for aluminum and possibly lithium. The theoretical limits of detection are in good agreement with those observed in practice, being about 20 ppm for the particular background and experimental arrangement used. (Author abstract modified)

217 APTIC NUMBER 17153

Billings, Charles E. and Leslie Silverman
AEROSOL SAMPLING FOR ELECTRON MICROSCOPY. J. Air Pollution Control Assoc., 12(12):586-590, Dec. 1962. 83 refs. (Presented at the 54th Annual Meeting of the Air Pollution Control Association, New York, N. Y., June 12-15, 1961.)

Aerosol sampling methods used in electron microscopy were briefly reviewed. These include directly exposing an uncoated specimen grid to the aerosol and allowing the material to deposit by random contacts. Exposure of micron or submicron rubber, asbestos, glass, or copper oxide fibers is also possible. Other simple sampling techniques include sedimentation of aerosol particles onto substrate coated grids. More specialized approaches include droplet sedimentation after freezing or drying and carbon replication of settled liquid droplets in gelatin. Air and liquid jet dispersion of previously collected material directly onto coated grids by direct interception or sedimentation is also possible. More recently, ultrasonic liquid aerosol generators were developed. Jet impactors were used for submicron particle collection but are of limited efficiency for very small particles of little inertia. Centrifugal aerosol analyzers were not used directly for sampling for electron microscopy, but their reported particle size separation indicates some collection in the size of interest. Advantages of membrane filters include operational flexibility in terms of flow rate and simplicity of sampling equipment. Disadvantages include rather lengthy processing before the sample can be observed and the distinct possibility of alteration of the particle material during dissolving steps. Advantages claimed for thermal precipitators include relatively gentle deposition and the ability to sample unattended for extended periods. Disadvantages include very small sampling rates, and possibility of sample particle deagglomeration. The oscillating thermal precipitator was developed to overcome the size stratification problem, but has a tendency to leak during collection plate motion. With the electrostatic precipitator, the sample is deposited directly onto a copper coated specimen grid. A satisfactory sample is obtained with the current on for a few seconds. This device permits isokinetic velocity to be established before turning the current on which is an improvement over the thermal precipitator. Very low aerosol stream velocity assures deposition of all particles of interest for electron microscopy.

218 APTIC NUMBER 16989

Boeseken, J. and H. D. Muller
ON THE EXACT DETERMINATION OF VERY SMALL QUANTITIES OF SULFUR-BEARING GASES (H2S, SO2 AND CS2) IN THE ATMOSPHERE WHEN THEY ARE PRESENT SIMULTANEOUSLY. (Sur le dosage exact de tres petites quantites de gaz contenant du soufre (H2S, SO2 et CS2) dans l'atmospere quand ils s'y trouvent simultanement). Text in French. Rec. Trav. Chim., vol. 50:1117-1124, 1931. 4 refs.

An exact method is presented for determining hydrogen sulfide, sulfur dioxide, and carbon disulfide concentrations in the atmosphere when they are simultaneously present. It is based on successive absorption of these gases: first, of H2S, by moist AgCl prepared by treating Ag2O, precipitated on asbestos, with HCl; second, of SO2, by MnO(OH) obtained by precipitating KMnO4 by alcohol on a porous refractory stone; and, third, of CS2, by Na alcoholate on a porous refractory stone. The concentration of S retained in this manner is determined by Moulen's method by transforming it into H2SO4 which is then determined iodometrically.

219 APTIC NUMBER 16763

Bostroem, Carl-Elis and Cyrill Brosset
A METHOD FOR SIMULTANEOUS DETERMINATION OF H2S AND SO2 IN FLUE GASES. Atmos. Environ., 3(4):407-416, July 1969. 6 refs.

A discontinuous method has been developed for the simultaneous determination of H2S and SO2 in flue gases. The method is based on a pure gas phase separation whereby H2S is adsorbed on a silica gel column impregnated with silver sulfate (Ag2SO4) and potassium hydrogensulfate (KHSO4), while SO2 is subsequently absorbed in a wash-bottle containing a slightly acidic hydrogen peroxide solution. Owing to the acid properties of the impregnated gel, SO2 passes through the column. The experiments show that the penetration of SO2 is quantitative while H2S is adsorbed quantitatively on the column. The method permits the determination of amounts of H2S in the range of 1-1500 mgMm/3 with a sampling time of 5 min and a gas flow of 0.2 - 4.0 l min/l. The lower limit for the determination of SO2 under the above conditions lies at about 1 mgMm/3. The separation of H2S and SO2 is not influenced by the presence of moderate amounts of water but the interference of ammonia is more serious. Ammonia is adsorbed on the column and the properties of the gel are changed so that SO2 is also adsorbed. The method is still, however, valid for H2S. The interference from organic sulfur compounds is negligible with the procedure. Hitherto the method has successfully been used to analyse H2S in ambient air in the ppb-range as 24-hr mean values. (Author's Abstract)

220 APTIC NUMBER 16969

Brandt, C. Stafford
FLUORIDE ANALYSIS. Intern. J. Air Water Pollution (London), vol. 7:1061-1065, 1963. 49 refs.

Methods and procedures for the detection and estimation of fluoride are reviewed. Difficulties associated with separating the particulate fluoride from gaseous fluoride are considered. The most satisfactory method developed to date is to collect the fluoride in a bubbler, fix it with alkali, and analyze the sample by water techniques. The need to fix fluoride samples with lime during drying and ashing has been established for plant materials but not for animal tissues. For analyzing plant and animal tissues and aqueous acidified solutions from air samples, isolation based on ion exchange resins has found increasing applications. For estimation of low levels of fluoride, after isolation from the sample, various colorimetric and spectrophotometric methods are replacing titration procedures. There is still no adequate automatic air monitoring instrument for fluorides, though field tests of a recorder based on the quenching of fluorescence on an impregnated tape appear promising. The detection limit is expected to be less than 0.1 micron F/cu m. Recently developed automatic systems for high level concentrations are subject to a wide variety of interferences.

221 APTIC NUMBER 17078

Brar, S. S., D. H. Nelson, E. L. Kanabrocki, C. E. Moore, C. D. Burnham, and D. H. Mattori
THERMAL NEUTRON ACTIVATION ANALYSIS OF AIRBORNE PARTICULATE MATTER IN CHICAGO METROPOLITAN AREA. In: Modern Trends in Activation Analysis. James R. Devoe (ed.), vol. 1, Washington, D. C., Natl. Bus. Standards SP312, Dept. of Commerce, 1969, p. 43-54. 4 refs.

A thermal neutron activation analysis in conjunction with NaI(Tl) crystal and gamma-ray spectrometry was used to detect 13 trace elements present in Chicago Metropolitan surface air. This number may be increased if a Ge(Li) detector is employed. Air particulate samples were collected simultaneously at 22 different locations. Each sample to be irradiated contained the dust from approximately 5 cu meters of air. Since some of the induced nuclides have short half lives, only two samples were irradiated for a period of 1 minute. Because neutron flux from one irradiation to the next cannot be assumed to be constant, an accurately weighed Mn standard was used as a flux monitor. The samples were re-irradiated for a period of 24 hours and counted at decay time of 1 and 2 months to determine some of the long-lived nuclides. The sensitivity of the system is such that the method can be used for routine measurements if dust is collected onto a clean filter.

222 APTIC NUMBER 16232

HIGHER OXIDES OF NITROGEN AS AN IMPURITY IN NITROUS OXIDE. Brit. J. Anaesthesia, 39(5):343-344, May 1969.

In the field of anesthesiology, little is known about the contamination of nitrous oxide with higher nitrogen. Moreover, testing for nitric oxide presents at least three problems that are not widely understood. First, samples of contaminated nitrous oxide must be drawn from the supernatant gas (although sampling of the liquid should also be used to detect nitrogen dioxide). Secondly, the more sensitive and widely used tests detect only nitrogen dioxide. The third problem arises from oxidizing nitric oxide to nitrogen dioxide with gaseous oxygen for detection purposes. More active oxidizing agents than oxygen at atmospheric pressure are needed for quantitative determination of nitric oxide. The effects of inhaling contaminated nitrous oxide can be considered due to the formation of hydrogen (hydronium) and nitrite ions by the reaction of nitrogen dioxide with body fluids. To prevent the distribution of contaminated cylinders, manufacturers must adopt appropriate measures of purifying, monitoring, and analyzing nitrous oxide. Furthermore, the limits of impurities which may be present in cylinder gases must be specified.

223 APTIC NUMBER 11767

Broussiche, R. A., I. L. Dujardin, H. E. Etienne, P. Rouet, R. L. Scohy, and P. H. Slootmaekers
TESTS OF ACEC VIDEOMETER IN FOG CHAMBER AT UNIVERSITY OF CALIFORNIA, BERKELEY, CALIFORNIA, U.S.A. (FINAL REPORT). Belgian Airports and Airways Agency, Brussels and Ateliers de Constructions Electriques de Charleroi (Belgium), Proj. 430-302-01N, SRDS Rept. FAA-RD-67-32, 51p., Aug. 1967.

Both manual and automatic versions of a videometer developed for measuring visibility along airport runways (RVR) were tested in fog chambers under conditions simulating three main types of fog: radiation, advection, and radiation. The results were correlated with human observations and results given at Brussels-National Airport under similar conditions. The fog chamber measurements completely confirmed those made at the airport. In particular, it was verified that the operation of a videometer is not affected by fog. The correlation between both types of videometer is not affected by fog. The correlation between both types of videometer and human observation was also excellent. The originality of the videometer consists of obtaining a TV image of a group of three lights instead of a full line of lights. The first and second of the three lights are faintly visible and the third, barely visible; the distance between the camera and the second light indicates the RVR value. The advantage of the videometer is that the use of three lights allows the evolution of the RVR to be observed and followed. Identification of the lights is facilitated by the illumination of pilot lamps corresponding to the ground lights.

224 APTIC NUMBER 11626

Brune, D., S. Mattsson, and K. Liden
APPLICATION OF A BETATRON IN PHOTONUCLEAR ACTIVATION ANALYSIS. Aktiebolaget Atomenergi (Stockholm), AE-333, 1968. 19 refs.

Determinations of iodine in pharmaceuticals and of fluorine, lead, and mercury in pure compounds were made by photonuclear activation analysis, with a betatron accelerator used as the irradiation facility. The accelerator yields a lower photon flux density than a linear accelerator but has great flexibility with regard to beam direction. Uniform irradiation of the samples was achieved by inserting a rotating sample holder device in the bremsstrahlung beam of the betatron. The detection limits obtained for iodine, fluorine, lead, and mercury were 50, 3, 400, and 15 micrograms, respectively. It is concluded that the betatron has practical applications in the field of pharmacy but is unsuited for lead analyses in pollution studies of air, water, and food. It could be used for the determination of mercury in various biological materials, though better results are expected to be obtained by conventional neutron activation techniques.

225 APTIC NUMBER 16765

Bryan, Robert J. and William H. Blackmore
CONTROLLED ATMOSPHERE EXPOSURE CHAMBER. Arch. Environ. Health, 18(5):848-854, May 1969. 6 refs.

A controlled environment chamber able to produce a wide range of exposure conditions was needed for continuation of study of air pollution effects on laboratory animals. The design concepts considered and selected are discussed. A room-sized chamber was constructed capable of automatically maintaining levels of single or mixed contaminants for prolonged periods. The system can add specific contaminants to the natural smog, or filter them out, or do both. The chamber can house 20 dogs or subhuman primates adequately. Air flow is laminar from side to side. The animal caging allows free air flow to eliminate micro-environments different from the macroenvironment of the room is adaptable to two or more species with somewhat different requirements, and allows safe handling of animals by research investigators. The cages are mobile, serve as metabolism racks, and are easily cleaned without disturbing the animal. The performance testing of the ventilation system, the dosing system, and the control system is discussed.

226 APTIC NUMBER 17082

Buck, H. and H. Stratmann
A METHOD TO DETERMINE VERY SMALL CONCENTRATIONS OF FLUORINE IONS IN THE ATMOSPHERE. (Ein Verfahren zur Bestimmung sehr geringer Konzentrationen von Fluor-Ionen in der Atmosphaere). Brennstoff-Chem. (Essen), 46(8):231-235, Aug. 1965. 13 refs. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 19p., Sept. 18, 1969.

A method was described by which fluorine ions are collected and absorbed in prepared silver tubes to determine very small F(-) concentrations in the air. After separation of the fluorine ions from interfering substances by water vapor distillation, the F(-) concentration is determined photometrically by the alizarine complex method. The distilled amounts of F(-) are absorbed in a small amount of diluted sodium lye. No water vapor condensation occurs at this process. The relative detection threshold of this method under standard conditions is 0.7 micrograms F(-)/cu m. The standard deviations were found to be + or - 0.4 micrograms F(-)/cu m in a concentration range from 2-10 micrograms F(-)/cu m. The sampling equipment can be easily installed in a truck so that the method is particularly suited for emission measurements which require sampling at different locations. As compared to the impinger method, this method has the advantage of having greater sensitivity and accuracy and is simple to handle. (Author summary modified)

227 APTIC NUMBER 16826

TWO SYSTEMS MONITOR H2S IN STACK GASES. Can. Chem. Process., 53(8):58-59, Aug. 1969.

The Murray H2S analyzer is a completely self-maintaining instrument for the continuous monitoring and control of the H2S and SO2 contents of flue gases to as little as 2 ppm. An installation will soon be made that integrates the instrument with process lines thereby controlling the pressure and flow of flue gases to the stack. The analyzer is based on the fact that SO2 strongly ultraviolet radiation in the wave/length region of 2850 Angstroms. The gas stream is split and the H2S in one stream is catalytically oxidized to SO2 and the components are then determined by difference. Another analyzer utilizes a modified electrolytic titrator in association with a sampling probe. The sensitivity reported to be better than 5 ppb for H2S in a 700 F flue gas.

228 APTIC NUMBER 17178

Cannon, Theodore W.
HIGH-SPEED PHOTOGRAPHY OF AIRBORNE ATMOSPHERIC PARTICLES. J. Appl. Meteorol., 9(1):104-108, Feb. 1970. 7 refs.

Individual airborne, precipitation particles (100 micron to several millimeters diameter) and cloud particle size droplets and ice crystals (10-100 micron diameter) are difficult to photograph because they are small and often have high velocity-to-size ratios. Nevertheless, photography of freely moving particles can provide information about the particles and their concentrations in an undisturbed or relatively undisturbed state. This paper discusses two cameras: one uses a bright-field illumination to photograph precipitation particles; the other uses a dark-field illumination to photograph cloud particles. The precipitation particle camera operates with approximately one-to-one magnification and is equipped with a 400-mm focal length Telephoto lens for photographing airborne water drops and snow and ice crystals. The camera for cloud droplet size particles also operates at one-to-one magnification. By using a very high resolution microfilm, particles down to 15 micron diameter can be accurately photographed for sizing and spatial distribution purposes. Both cameras have been successfully used at ground level. For taking photographs from aircraft, mechanical motion compensation will be required if nonstreaked images are to be produced.

229 APTIC NUMBER 16762

Carey, A. W., Jr., P. J. Hills, T. O. Wagner, D. K. Lawrence, F. Pinolini, and J. Spiers
DIESEL SMOKEMETER CORRELATIONS ESTABLISHED IN STEADY STATE. S.A.E. (Soc. Automot. Engrs.) J., 77(7):59-62, July 1969. 3 refs.

Steady-state correlations between the various diesel smokemeters have been defined by three experimental studies. The investigations, which produced essentially complementary results, were conducted by: A Task Force of the SAE Truck and Bus Technical Committee, the Diesel Smokemeter Group of the Coordinating Research Council (CRC); and the Smoke Measurement Subcommittee of the Coordinating European Council (CEC). Only the grey variety of smoke was considered. (Author's Summary)

230 APTIC NUMBER 16786

Charlson, R. J., N. C. Ahlquist, H. Selvidge, and P. B. MacCready, Jr.
MONITORING OF ATMOSPHERIC AEROSOL PARAMETERS WITH THE INTEGRATING NEPHELOMETER. J. Air Pollution Control Assoc., 19(12):937-942, Dec. 1969. 11 refs.

The integrating nephelometer of Beuttel and Brewer has been adapted successfully for continuous, objective monitoring of atmospheric aerosols. The paper includes a summary of work done to date with this improved device. In particular, the following points are discussed: (1) the design and operation of the instrument; (2) calibration of the instrument; (3) correlation of nephelometer output to the mass concentration of atmospheric aerosol; (4) correlation of nephelometer output with visual range; (5) the wavelength dependent nephelometer and the regularity of the wavelength dependence of haze; and (6) application of integrating nephelometer to mobile reconnaissance of aerosols. The utility of the integrating nephelometer for monitoring visibility and aerosol mass concentration is also emphasized. (Author's Abstract)

231 APTIC NUMBER 16754

Cleary, Graham J.
THE CLASSIFICATION OF ODOURS. Clean Air (J. Clean Air Soc. Australia New Zealand), 3(1):13-15, March 1969. 13 refs.

The classification of odors is difficult because of the inability to describe the stimulus. A number of classification systems that have been devised since 1855 are discussed. Most are subjective based on a pleasant-unpleasant reaction with subgroup classes such as fresh, pungent, etc. One system eliminates most of the subjectiveness found in earlier schemes by classifying odors on the basis of adsorption on some common surface active agents. Extension of this work should make it possible to define odor quality even more precisely.

232 APTIC NUMBER 16848

Cooper, Douglas W. and B. Lee Byers
LASER LIGHT BACKSCATTERING FROM LABORATORY AEROSOLS. J. Air Pollution Control Assoc., 20(1):43-47, Jan. 1970. 10 refs.

Laser light backscattering is being used increasingly to measure ambient particulate concentrations. In this study, a small volume of aerosol confined by flowing filtered air was illuminated by a He-Ne laser, and the light scattered at 175 degrees from the forward direction was measured. NaCl, KCl, and NaBr crystals were atomized from 1 and 8% (w/v) solutions to form size polydisperse aerosols whose light scattering was found to be more closely related to volume of aerosol per volume of air than to mass or surface area of aerosol per volume of air, the average backscattering was 4 x 10 to the minus 15 watts per 10 to the minus 14 cu cm of aerosol illuminated by .0026 watts and scattered into .0044 steradians solid angle, for aerosols having mass mean diameters from 0.2 to 0.4 microns. The paper gives the aerosols' size distributions as determined by electron microscopy, as well as their mass concentrations and backscattering. No simple relationship was noticed between scattering and index of refraction. Monodisperse polystyrene latex aerosols were also tested and scattered approximately as much light as expected from the Mie theory. (Author's Abstract)

233 APTIC NUMBER 16089

Digby, W. P.
PHOTOMETRIC STUDY OF ATMOSPHERIC POLLUTION. Quart. J. Roy. Meteorol. Soc. (London), 63(269):163-180, April 1937. 1 ref.

A photometric method of comparing the loss of reflecting value through tarnishing of polished metal plates was described. The wide daily and seasonal effects of changes in the polluting media in the atmosphere for different metals simultaneously exposed in the same place were shown. The different rates of tarnishing of the same metal plates exposed during the same week in rural areas, in London, and in industrial areas were very marked. Extreme cases in Westminster for polished copper included losses of 38 and 50% in five hours in December fogs. On four successive days in February, 1936, the loss in five hours varied between 5 and 11%. For a summer day in 1935, a 10% loss in 24 hours seemed normal. For short periods of one to two days in the winter and a week in the summer, copper is a good indicator. For longer periods, fine silver is better. Aluminum responds slowly, while the useful range of nickel appears to be between those of copper and of silver. In the two appendices, the loss of reflection value was correlated with independent measurements of sulfur in the atmosphere. Further study was indicated for metal plates shielded from rain, dust, soot, and other deposits to give an index of gaseous impurities only. (Author summary modified)

234 APTIC NUMBER 15632

Dokladalova, J. and S. Banas
SELECTIVITY OF THE DETERMINATION OF SULFUR IN ORGANIC COMPOUNDS. (Zur Selektivitaet der Schwefelbestimmung in organischen Material). Text in German. Mikrochim. Acta, no. 4:741-748, 1969. 18 refs.

The influence of the halogens and nitrogen compounds on the combustion of a sulfur-containing sample in an empty quartz tube and on the subsequent spectrophotometric analysis of SO2 as p-rosanilinemethane sulfonic acid was studied. Combustion of the test substances and the spectrophotometric analysis were previously described in another paper, and only the modifications are described in this paper as follows: test solutions of various concentrations of halogen compounds were burned in sulfur-free diethylphthalate, or they were burned without solvent. Standard solutions containing sulfur as well as halogens were burned. Two modifications of the standard method were made in the nitrogen test: standard solutions containing various nitrogen compounds were burned in sulfur-free dimethylphthalate. The combustion products were absorbed in 8 ml of 0.1 M Na2HgCl4; the resulting solution contained 7 micrograms of dichlorosulfitomercurate. Standard solutions which contained sulfur compounds as well as nitrogen compounds were burned. It was found that interference by the halogens depends on their absolute quantities and not on their percentage. No halogen interference was observed during the combustion; they seem to interfere only in spectrophotometric determinations. A maximu of 100 micrograms chlorine, 10 micrograms bromine, and 10 micrograms iodine may be present. Interference by nitrogen compounds depends on compound type. Some compounds change the ratio of SO2 to SO3 in the gas phase during spectrophotometry.

235 APTIC NUMBER 16753

Drushel, Harry V.
SULFUR COMPOUND TYPE DISTRIBUTIONS IN PETROLEUM USING AN IN-LINE REACTOR OR PYROLYSIS COMBINED WITH GAS CHROMATOGRAPHY AND A MICROCOULOMETRIC SULFUR DETECTOR. Anal. Chem., 41(4):569-576, April 1969. 2 refs.

A rapid method for determination of sulfur compound types in petroleum was developed which involves dealkylation of the condensed thiophenes using an in-line catalytic reactor or noncatalytic pyrolysis. The resulting reaction products were separated by gas chromatography and the compounds containing sulfur were quantitatively detected with a Dohrmann microcoulometric sulfur detector. Nonthiophenic compounds, primarily aliphatic sulfides, were converted to H2S and detected in the same manner. Precision was 2 to 3 percent and analysis time was 1 hour. Data agreed very well with high resolution mass spectrometric analysis. Results from use of the method on hydrodesulfurized vacuum gas oils showed that the ease of desulfurization followed the order: Benzothiophenes greater than dibenzothiophenes greater than benzonaphthothiophenes. (Author's Abstract)

236 APTIC NUMBER 17313

Eguchi, Tadashi
ANALYZERS IN AIR POLLUTION STUDY. (Taiki osen no sokutei sochi ni tsuite). Text in Japanese. Nenryo Oyobi Nensyo (Fuel and Combustion), 36(112):1212-1217, Dec. 1, 1969. 7 refs.

Six methods of analyzing sulfur oxides in exhaust gas are reviewed: neutralization, thorin, barium chloranilate, iodimetric titration, detector tube and automatic analysis. These methods are to be specified by the Japan Industrial Standard. The first three determine the concentration of sulfur dioxide and sulfur trioxide; the others analyze sulfur dioxide only. In the first three, a quantity of sample gas is absorbed in a hydrogen peroxide solution which is then titrated by caustic soda, analyzed by chelatometric titration, or measured with regard to the change of the absorbance caused by the coloring of barium chloranilate. In iodimetric titration, a sulfanilate solution is used. The detector tube method is used when a high degree of accuracy is not required; the change in the length of the coloring zone (silica gel with color reagent) indicates the concentration of sulfur dioxide. The recommended automatic methods are ductometry and infrared analysis. In the conductometric method, the increase in conductivity of the absorbent solution (hydrogen peroxide) is measured. The addition of sulfuric acid is effective for stability and accuracy of measurement. In infrared analysis, nondispersive analyzer which takes advantage of the infrared absorption of sulfur dioxide, is used when moisture must be removed from the gas sample. Analyzers for automotive exhaust gases and other atmospheric pollutants are briefly reviewed. Hydrocarbons, are analyzed by the hydrogen flame ion or gas chromatographic methods.

237 APTIC NUMBER 17150

Ettinger, Harry J. and Samuel Posner
EVALUATION OF PARTICLE SIZING AND AEROSOL SAMPLING TECHNIQUES. Am. Ind. Hyg. Assoc. J., 26(1):17-25, Jan.-Feb. 1965. 9 refs.

Aerosol sampling and particle sizing techniques from several laboratories were compared. Variations up to plus or minus 10% in count median diameter were found when comparing sizing results from different laboratories. Count median diameters determined on the basis of maximum horizontal diameter (Feret's diameter) were approximately 10% higher than those determined on the basis of equivalent area (projected diameter). Because of this variation, the method of sizing must be specified when reporting aerosol characteristics. Variations up to plus or minus 15% in geometric standard deviation were found when comparing sizing results from different laboratories. Because of these variations, mass median diameters (calculated from the Hatch and Choate equation) differed by as much as 2.7 times that for any one sampler and 6.7 times that for all samplers. The difference was accentuated when extreme values of count median diameter and geometric standard deviation coincided. Mass median diameter calculated from the Hatch and Choate equation did not correlate with mass median diameter calculated by cubing diameters and plotting cumulative percent less than mass basis vs Diameter on log probability paper. Variations in count median diameter, geometric standard deviation, and mass median diameter within individual laboratories were small. This is probably due to uniform instructions, uniform equipment, uniform calculation techniques, and re-evaluation of extremes within a group. (Author summary modified)

238 APTIC NUMBER 16995

Draegerwerk, Heinr. and Bernh., Luebeck (West Germany)
METHOD TO PROVE OR DETERMINE PHOSPHOROUS AND/OR SULFUR CONTAINING COMPOUNDS IN THE AIR OR OTHER GASES BY FLAME PHOTOMETRY AND ITS EQUIPMENT. (Verfahren zum Nachweis oder zur Bestimmung von phosphor und/oder schwefelhaltigen Verbinddungen in Luft oder anderen Gasen mittels Flammenfaerbung und Vorrichtung fuer deren Durchfuehrung). W. German Pat. 1,133,918. 4p., July 26, 1962. (Appl. Jan. 19, 1961, 10 claims). Translated from German. Franklin Inst. Research Lab., Philadelphia, Pa., Science Info. Services, 7p., Sept. 18, 1969.

The presence of phosphorous- and sulfur-containing compounds in air is determined by spectrophotometric measurements of the coloration of hydrogen flames produced by the injection of gas, which contains oxygen or is mixed with oxygen, in a hydrogen stream. More hydrogen is provided than is necessary for complete conversion of oxygen. The flame coloration is measured in a dark zone at some distance from a first flame where the intensity of the background glow of the flame is negligible over the intensity of flame coloration. Phosphorous compounds are determined in a zone of one to two flame lengths distant from the first flame; sulfur compounds, in a zone five to fifteen flame lengths distant. Equipment required for measurements include quartz or glass capillary tubes; a cylinder for enclosing the hydrogen flame, which is preferably cooled by water; and the spectrophotometer for measuring flame coloration in the spectral range around 520 micron for phosphorous-containing compounds and 380 micron for sulfur-containing compounds.

239 APTIC NUMBER 17231

Fujie, Kiniko
DETERMINATION OF SUGARS AND OTHER ALPHA-GLYCOLIC DERIVATIVES IN AIRBORNE PARTICULATES. (Taikifunzin chuno to oyobi alpha-glycolic derivatives no sokutei). Text in Japanese Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 3(3):153-158, Dec. 1, 1969. 6 refs.

The direct and the oxidative 3-methyl-2-benzothiazolinone hydrazone hydrochloride methods for determining alpha-glycolic compounds were compared. A high-volume air sampler was used to collect atmospheric particulates in a glass-fiber filter. The water-bath extraction of the sample was filtered, and the reagent added. After heating for 3 min in a boiling water bath, the sample was cooled to room temperature. Twenty to forty minutes after 0.5% FeCl3 and 1% HOSO2NH2 were added, the sample was subjected to an absorption measurement by Hitachi-type 124 double-beam spectrophotometer. Beer's Law was confirmed in the 0-20 microgram/ml concentration range of ribose and in the 0-5 microgram/ml range of formaldehyde. The reaction time for the quantitative analysis and the effects of SO4(2-), NO3(-), and aniline were examined. In terms of standard deviation, the accuracy of analysis was plus or minus 5.0% by the oxidative method, and plus or minus 4.6% by the direct method. One week after sampling, a decrease in absorption was observed. With this method, water-soluble alpha-glycolic compounds in Osaka city were measured in the 0.5-5.8 micrograms/cu m range in air, and 1-24 microgram/g range of particulates. A correlation was found between the concentrations of alpha-glycolic compounds and airborne particulates with 1% judgment standard.

240 APTIC NUMBER 17254

Fukaya, Morihei
THE TELEMETERED AIR MONITORING NETWORK. (Keisoku ni yoru taiki osen no shuchu jido kanshi hoshiki ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 3(4):223-228, April 15, 1967.

Accurate and precise measurement and evaluation of collected data to take control steps are essential for air pollution control. Advantages of the telemeter system for prompt air pollution control are currently recognized. As stated in the Japanese Law of Air Pollution Control, emergency procedures are based on conditions such as sulfur oxide density and meteorological factors. Emergency procedures are timed to coincide with continuous measurements and present accurate data for a designated area. To adjust these circumstances, the establishment of a telemetered air monitoring network in serious pollution areas and financial aid are required and are officially decided upon by the Ministry of Public Welfare. Analog and digital types applied to telemetering techniques have different merits and capabilities. Generally, the analog technique is applicable for one or two particulate matter measurements in one monitoring station and the digital technique is advantageous for more than 4 measurements. The analog and digital telemeter systems were illustrated. The telemetering network in Chicago and New York were introduced. Compared with air pollution control in other countries, Japanese methods are not inferior in terms of modern equipment, numbers of observation stations, placement of telemetering networks by area, and meters and instruments installed at those stations.

241 APTIC NUMBER 17024

Fukushima, Tatsuhisa, Hineo Shibano, and Touichi Ohtani
SPECTROMETRIC DETERMINATION OF MASS OF HYDROCARBONS AND NITRIC OXIDE IN AUTOMOTIVE EXHAUST GAS. (Jidosha haiki gasu chu no tanka suiso oyobi chisso sankabutsu shitsuryo bunseki). Text in Japanese. Jidosha Gijutsu (Automobile Eng.), 23(4):291-295, 1969. 7 refs.

Hydrocarbons and nitric oxide in automotive exhaust gas contribute to smog formation. Each hydrocarbon molecule type has a different smog formation potential. Mass spectrometric analysis for hydrocarbons and nitric oxide was developed. A continuous hydrocarbon and nitric oxide batch analysis was also established. (Author abstract modified)

242 APTIC NUMBER 15652

Fusamura, Nobuo
DUST MEASUREMENT TRENDS IN FOREIGN COUNTRIES. (Kakkoku ni okeru funjin sokutei no doko). Text in Japanese. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo), 7(3):1-8, Oct. 25, 1969. 24 refs.

Standard methods and apparatus for dust measurement used in Austria, Canada, Czechoslovakia, France, West Germany, Italy, Holland, Poland, Union of South Africa, England, and the United States are described. Trends at present and recent progress

reported at the 3rd International Conference on Pneumoconiosis are discussed. Additional comments on asbestos dust measurement and development in dust measurement activities in the Union of South Africa are also presented. The conventional method for dust measurement by means of dust particle concentration has been replaced by a quality-quantity measurement method which is relatively objective in assessment as compared with the dust particle concentration method. The progress of the quality-quantity measurement method was accelerated by the improvement in particle separating instruments, such as the HCB/HRE dust sampler or the Doregel STI sampler. Another marked trend was the mechanization of handling figures obtained by the dust particle concentration method. Objective estimation is regarded as rather difficult so far; thus the mechanized system is preferred. In accordance with this trend, a new type of dust meter which both measures and indicates dust particles simultaneously is presented. Past development of dust measurement activities in the Union of South Africa, which has 70 years' experience in dust measurement activities in mining, is grouped in six stages. The method of dust measurement and its assessment varies widely among countries, and is a serious obstacle in exchanging data and information. Establishment of a standardized method for assessment on an international scale is recommended.

243 APTIC NUMBER 11706

Gibson, A. David
A TAPE PROGRAMMED SEQUENTIAL SAMPLER. National Center for Atmospheric Research, Boulder, Colo., Contract NSF-C-460, 4p., 1967.
CFSTI: PB-175925

An automatic sequential sampler, developed for a field program of particulate sampling on filters, is illustrated in two diagrams. The invention uses a perforated 33 mm mylar film to program the filter sequence and a synchronous motor timer to control the on-off cycle. The film, which is advanced through a set of manifold blocks, uncovers a single vacuum port at a time. At the end of a full sequence of filters, the film is advanced to a position where all ports are closed and the sampler shut off by a vacuum switch. Any desired program can be set by changing the tape and the on-off timer. Filters may be run simultaneously for different periods of time and the film looped to repeat the filter sequence. Requiring no rotary or solonoid valve, or expensive timers, the instrument is an inexpensive and a reliable sampler.

244 APTIC NUMBER 17162

Grantham, L. F., E. B. Harrelson, P. H. Shaw, and C. M. Larsen
CELL ASSEMBLY TO MEASURE THE ELECTRICAL CONDUCTIVITIES OF MOLTEN SALTS TO THEIR CRITICAL TEMPERATURES. Rev. Sci. Instr., 39(5):699-702, May 1968. 11 refs.

A cell assembly was constructed and tested to measure the electrical conductivities of fused salts up to their critical temperatures. The apparatus consisted of a quartz conductivity cell enclosed in a pressurized Hastelloy N container. Rupture of the quartz cell was prevented by application of external pressures slightly greater than the internal vapor pressure of the salt. Bismuth chloride, with a critical temperature of 905 C and critical pressure of 120 bars, was used as the test liquid. At the conclusion of the tests, the BiCl3 was slightly discolored. This was probably due to corrosion of the tungsten electrodes at high temperatures. However, conductivity determinations from different temperature cycles in a run were in good agreement. Thus conductivity determinations made with the assembly were valid, even though there may have been a slight error due to melt impurities. Preliminary results showed that the electrical conductivity of the liquid increased from 0.36/ohm cm at 229 C to a maximum of 0.58/ohm cm at 425 C, then decreased to about 0.008/ohm cm at 905 C. The conductivity decreased rapidly in the subcritical region just as the density decreased rapidly in this temperature range. The results indicated that this technique can be used to measure electrical conductivities of molten salts to temperatures of 905 C and vapor pressures of 120 bars. It was concluded that this technique can be extended to measure conductivities to higher temperatures and pressures.

245 APTIC NUMBER 15634

Grasley, M. H., B. R. Appel, I. G. Burstain, J. L. Laity, and H. F. Richards
THE RELATIONSHIP OF SMOG CHAMBER METHODOLOGY TO HYDROCARBON REACTIVITY IN POLLUTED AIR. Am. Chem. Soc. Div. Org. Coatings Plastics Chem. Preprints, 29(2):422-426, 1969. 4 refs.
(Presented at the 158th Meeting of the Am. Chem. Soc., Div. Organic Coatings and Plastics Chemistry, New York, Sept. 1969.)

The influence of relative humidity on the smog-producing properties of 1.0 ppm toluene and 0.5 ppm NO in ultrapure air was observed in a stainless steel smog chamber in which the only variable parameter was the method of cleaning the chamber. The half-life of toluene decreased from 265 min at 0% relative humidity to 65 min at 43%. Similarly, the rate of conversion of NO to NO2 increased with higher humidity. Striking accelerations of the rates of NO2 and ozone formation and hydrocarbon disappearance were noted when the chamber was evacuated and heated overnight prior to irradiation. With evacuation as the only cleaning step, NO2 formation for 1.5 ppm toluene and 0.6 ppm NO at 21% humidity was 6.9 ppb/min. With cleaning by evacuation and heating, the rate was 11.0 ppb/min. When the chamber was dosed with 1 ppm of NO2, NO2 formation rose to 15-20 ppb/min. Consistently low formation rates were obtained when the chamber was washed with trichloroethylene and water. This cleaning method, followed by NO2 conditioning, is recommended to maintain reproducible chamber behavior. The humidity phenomenon was also observed with 2.0 ppm toluene and 1.0 ppm NO in a Pyrex flask; NO2 formation doubled in going from 0 to 60% humidity. The disappearance of toluene and the formation of ozone was also accelerated by high humidity. It is concluded that when a scale of hydrocarbon reactivities is being developed for polluted air, the humidity must be known and held constant throughout a given series of experiments.

246 APTIC NUMBER 17090

Gray, T. A. and E. B. Kuczynski
CALIBRATION OF SO2-MONITORING INSTRUMENTS. ISA (Instr. Soc. Am.) Trans., 7(4):327-331, 1968. 8 refs. (Presented at the 14th National Symposium, Analysis Instrumentation Division, Instrument Society of America, Philadelphia, Pa., May 19-22, 1968.

Since sulfur dioxide is one of the parameters of air pollution receiving much of the initial attention, calibration of SO2 analyzers is discussed in detail, with the assumption, that it will have relevance to other analyzers as well. Calibration techniques associated with high-level measuring devices differ from those for low-level instruments. Each is discussed, and examples of methods for both field and laboratory calibrations are offered. To obtain optimum performance of any instrumental method, the method must have as its requisites reproducibility, simplicity, and accuracy. There will be disagreement when one calibration method is compared to others. The reasons for the disagreement are given. The lack of suitable primary standards that can be used under all operating conditions is an outstanding short-coming. It would be most desirable to adopt some method as a primary standard, even though it is known to have certain deficiencies. For example, in SO2 analysis, the commonly accepted standard is that of the West and Gaeke colorimetric method. However, several alternative, secondary standard methods should be established. These secondary standards could be taken out and applied directly and easily to equipment being operated in the field. Some of these standards include the use of permeation tubes, syringe-dilution techniques, direct dilutions in plastic bags, and gas dilution in cylinders. Although no universally-acceptable calibration technique is available, suitable primary and secondary standard methods can be used if the results are interpreted correctly.

247 APTIC NUMBER 17290

Hasauzu, Yoshio
ODOR PERCEPTION MEASUREMENT BY THE USE OF ODORLESS ROOM. (Mushushitsu ho ni yoru shuki kanno sokutei). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 5(12):718-723, Dec. 25, 1969. 7 refs.

The function of the olfactory organ and some problems involved in olfactory testing with the use of an odor panel, the preparation of an odorless testing room, and other problems which are commonly observed in conducting qualtitative odor measurements were described. It is characteristic of the olfactory organ that the duration of odor perception is an extremely limited function, due to quick fatigue. This was construed to be a function of adjustment. Of nearly 2,000,000 chemical compounds which are known, one-fifth or 400,000 compounds, have odor, but only one percent of the one-fifth have pleasant odors. Empirica attempts were aimed at systematizing odor and the function of olfactory organ according to a scientific method, but they were not very successful. For this reason the measurement of odor perception is largely dependent on use of an odor panel or an observation group. Subjective judgement may be unavoidable in an olfaction test. To minimize measurement errors several conditions are required: people around 20 years have the most perceptible olfaction; sensitivity declines with age and the most qualified persons are between 20 and 40 years old; very few differences exist between males and females, but an equal number of both should compose a panel; mental and physical health is of primary importance; and reasonableness and stability of both olfactory perception and the judgement standard decide success to a great extent. The triangle test, the matching test, the ranking test, and others can be applied for panel screening. Procedures of odor perception measurement by the use of an odorless room were explained.

248 APTIC NUMBER 16582

Harkness, A. C. and B. A. Kolman
SOLUBILITY OF METHYL MERCAPTAN IN WATER. TAPPI, 50(1):13, Jan. 1967. 6 refs.

The solubilities of methyl mercaptan and H2S in water were determined by measuring the volume of gas absorbed at constant pressure. The solubility of methyl mercaptan was found to be proportional to its pressure up to 700 mm, the highest pressure used. At 30 C, its solubility is found to be 4.90 vol/vol/atm and that for H2S, solubility is 1.86. The heat of solution of methyl mercaptan is calculated to be -6.2 kcal/mole and its solubilities in 0.05M H2SO4, 1M H2SO4, 0.1M NaSCH3, 1M NaCl, and 1M Na2SO4 are, respectively, 5.06, 4.29, 5.29, 3.94, and 2.24 vol/vol/atm.

249 APTIC NUMBER 16727

Hawkins, L. H. and T. H. McEwen
TECHNIQUE FOR THE PROLONGED EXPOSURE OF ANIMALS TO A CONTROLLED ATMOSPHERE. Lab. Pract. (London), 18(4):438-440, April 1969. 6 refs.

Two types of apparatus are described which can be used for the exposure of experimental animals to controlled atmosphere. The first type was designed to operate reliably for periods of up to a year in order to study the long-term effect of exposure to gases such as carbon monoxide. The second type was designed to allow procedures to be carried out on animals with or without anaesthesia in short-term investigations on the effects of toxic gases. (Author's Abstract)

250 APTIC NUMBER 17282

Hayakawa, Kazuya
MEASUREMENT OF MINUTE PARTICLES IN A TURBULENT FLOW. (Ranryuchu no niryushi no sokutei nitsuite). Text in Japanese. Kukichowa Eisei Kogakd (J. Japan Soc. Heating Air Conditioning Sanitary Engrs.) 44(1):3-8, Jan. 25, 1970. 16 refs.

Complications due to particle size distribution in the sampling of airborne particles were avoided by direct observation of scattered light in a turbulent flow. A binary turbulent flow of aerosols was formed in a cloud chamber by atomizing an ammonium chloride solution using Wells apparatus. Scattered light from the Tyndall phenomenon was monitored with a photometer, and its

decay was recorded. The particle diameter was calculated from the light scatter decay using Stokes formula. A mixture of particles of 0.5-5.0 micron diameter was classified into 4 grades according to their geometrical mean diameters, from which particle size distribution could be calculated. Other methods of particle size determination were also described, together with definitions of the average diameter of particles.

251 APTIC NUMBER 16305

Heinl, E.
THE HYGIENIC EVALUATION OF AIR POLLUTION BY THE RELATIVE INDEX. (Hygienicke hodnoceni znecisteni ovzdusi pomoci relativniho indexu). Text in Czech. Czech. Hyg., 11(6):340-348, 1966. 8 refs.

A method is described for evaluating both qualitatively and quantitatively air pollution from industrial sources by means of a 'relative pollution index' (RPI). This index is determined on the basis of average wind velocity, technical parameters of the source, and from data regarding the quantity of discharged material, the prevailing wind direction at a given location and time of year, and the maximum permissible concentration of pollutants. The RPI makes it possible to evaluate the relative difference in air pollution at various points in the vicinity of the source at any given time or during the course of a prescribed time interval. The RPI also makes possible a direct comparison of the presence of various components in mixed pollution on the basis of maximum permissible concentrations. The suitability of this method has been verified in air quality control programs, especially in planning the construction of new industrial plants and multiple dwellings and in selecting locations for air pollution sampling stations. For a cumulative evaluation of a locale, individual RPI values can be combined in plotting an area diagram which reveals primarily the process dynamics.

252 APTIC NUMBER 16682

Hillman, D. E.
COMPARISON OF ELECTRON CAPTURE DETECTORS USED IN GAS CHROMATOGRAPHY OF PESTICIDES. Chemical Inspectorate, London (England), C. I. M-218, 15p., Dec. 1967. 3 refs.
CFSTI, DC: AD 686051

The properties of three detectors used to determine small amounts of pesticides were compared. The Pye macro argon ionization detector, the Pye electron capture detector, and the Aerograph detector were evaluated by examining the effect of sample size, applied voltage, and gas flow on detector response to solutions of gammexane, dieldrin, or aldrin. The influence of applied potential and flow rate on standing current was determined by plotting applied potential against standing current; the effect of sample size and applied potential was obtained by plotting peak height against sample size at different applied potentials. The Aerograph detector has greater linear range and sensitivity that the Pye detector, but shows less sensitivity to changes in flow rate and applied potential. The argon ionization detector has insufficient sensitivity for the determination of pesticides.

253 APTIC NUMBER 16721

Kaye, S. and J. E. Koency
A SOLID STATE OZONE GENERATOR. Rev. Sci. Instr., 40(3):505-506, March 1969. 2 refs.

A small solid-state generator for preparing ozone in known concentrations to 1000 ppm in air for use in laboratory studies is discussed. Assembled from common electronic components, it is stable, reliable, inexpensive, and requires no cooling. The circuit and assembly is described in detail.

254 APTIC NUMBER 17149

Kniseley, Sharon J. and Lewis J. Throop
P-AMINOAZOBENZENE FOR THE SPECTROPHOTOMETRIC DETERMINATION OF SULFUR DIOXIDE. Anal. Chem., 38(9):1270-1271, Aug. 1966. 7 refs.

The dye, p-aminoazobenzene, was tested for the spectrophotometric determination of sulfur dioxide in order to obtain a more sensitive technique than with pararosaniline. Concentration effects of acid, dye, and formaldehyde were studied to determine the optimum conditions for the reaction. It was found that a few milliliters of concentrated hydrochloric acid added to the SO2-dye-formaldehyde solution heightened the color. A final acid concentration of 0.61 N was chosen for the reaction, as it gives a stable color of high absorbance. An increase in dye content above the 5-ml level did not result in any appreciable increase in sensitivity. A variation of 1 ml in the amount of formaldehyde reagent resulted in a 2% change in the absorbance and showed a very small effect on color development. P-aminoazobenzene gave an absorbance differece of 0.64 with 100 micrograms of SO2, or double the sensitivity of the same procedure using pararosaniline. A calibration curve can be prepared in the 0-10 microgram range of SO2. Both he 0-10 and 10-100 microgram system obey Beer's law.

255 APTIC NUMBER 16690

Knollenberg, Robert G.
AN OPTICAL-ELECTRICAL PARTICLE SIZE DISCRIMINATOR. Univ. Corp. for Atmospheric Research, Contract NSF C-460, 22p., April 2, 1968.
CFSTI: PB 179645

The invention of an optical-electrical device for measuring the size and number of all types of particulate matter and objects is disclosed. Measurement of the size of the shadow of a particle passing through a collimated light beam is achieved by using a linear array of light-carrying filter optics which are illuminated by the collimated light. The loss of light that results when a particle passes between the light source and the fiber optics array causes electrical pulses to be produced in photodetectors. The pulses of each detector are summed by logic circuitry and the size of a particle is thus determined by the number of fibers the shadow interrupts. Two complete particle size measuring systems have been constructed from the invention. One is a prototype unit

useful in testing and calibration. The second is used in an aircraft installation to measure the size of water drops and ice crystals in the atmosphere. The prototype system resolves particles in 150 micron fiber diameter units and will measure size + or - 75 microns. The aircraft probe was used for particles 100 microns or larger. Other applications of the invention include size monitoring in the production of all powders and particles, such as granulated foods, fertilizers, and detergent cleaners.

256 APTIC NUMBER 17306

Knollenberg, Robert G.
THE OPTICAL ARRAY: AN ALTERNATIVE TO SCATTERING OR EXTINCTION FOR AIRBORNE PARTICLE SIZE DETERMINATION. J. Appl. Meteorol., 9(1): 86-103, Feb. 1970. 5 refs.

Two airborne optical-array particle measuring systems were fabricated and are being studied in the field. These systems measure the sizes of shadows produced by precipitating particles passing through a collimated, high-intensity, polychromatic light beam. They are capable of measuring particle size and concentration at high sampling rates without disturbing the sample. One instrument is described in detail and preliminary results of field tests are presented. The tests are believed to be the first successful application of linear arrays to particle measurement problems. Although the optical array cannot resolve particles of a size comparable to the wavelength of light or below, it does meet the desired design criteria for most cloud physics work, i.e., adequate measurement of particle size and concentration in the cloud droplet through precipitation size range. In this size range, it provides for a higher sampling rate and better resolution than other optical techniques with fewer coincidence errors and no 'edge-effect' errors. The system is immune to higher noise and tolerant to stray light, drift, or soiling of optical components. In the coming months, the instrument will be used to obtain cloud and precipitation particle size distributions for a variety of mesoscale cloud situations.

257 APTIC NUMBER 16773

Knuth, R. H.
RECALIBRATION OF SIZE-SELECTIVE SAMPLERS. Am. Ind. Hyg. Assoc. J., 30(4):379-385, July-Aug. 1969. 13 refs.

The Lippman-Harris size-selective samplers were recalibrated using monodispersed aerosols. The test aerosols were Dow polystyrene and polyvinyl-toluene latexes produced by atomization, and methylene blue and iron oxide particles produced with a spinning-disc generator. The settling velocity of the monodispersed aerosol was measured and converted to the size of a unit density sphere having the same settling velocity. This was done to eliminate the incongruities found when determining the particle size and density by conventional methods. The "Respirable Dust Standard" (Los Alamos curve) was found to be best approximated by flow rates of 8 liters/min and 1.4 liter/min for the 1/2-inch stainless-steel and 10-mm nylon samplers, respectively. These flow rates are lower, by a factor of 2, than those reported by Lippmann and Harris, who used polydispersed uranium oxide for their calibration. (Author's Abstract)

258 APTIC NUMBER 17036

Kogan, Ya. I. and M. E. Pankratova
DEPENDENCE OF LIGHT SCATTERING ON PARTICLE SIZE IN AEROSOL NEPHELOMETERS WITH VIEWING ANGLES OF 90 AND 135 DEG. Colloid J. (USSR) (English translation from Russian of: Kolloidn. Zh.), 31(4):496-500, July-Aug. 1969. 8 refs.

Twenty-four variants of nephelometric measurements possible with KOL-45 and KOL-90 aerosol nephelometers (two scattering angles, four spectral regions, and three positions of the polarization analyzer) were applied to each particle size in monodisperse and highly disperse aerosols. The dependence of light scattering on the size of spherical transparent particles in monodisperse aerosols was determined for radii in the range 0.02 less than or equal to r less than or equal to 2.0 micron. The refractive index of the substances constituting the disperse phase was close to 1.5. In the case of particles with a radius of 0.2 micron, the scattered light was found to be practically unpolarized; with larger particles, the excess component of the scattered light was perpendicular to the plane of vision. Various methods are described for determining average particle radii and of particle number and weight concentrations of aerosols from the results of nephelometric measurements, with the aid of calibration data obtained in the investigation. The experimental results are compared qualitatively with theory.

259 APTIC NUMBER 17276

Kosmowski, Alfred
RADIONUCLIDES IN SCIENTIFIC AND TECHNICAL FIELDS. (Radionuklide in Technik und Wissenschaft). Text in German. Wasser Luft Betrieb, 13(12):469-471, Dec. 1969. 3 refs.

The utilization of radionuclides in science and engineering is one of the most important and most developed branches of the peaceful use of nuclear radiation. Many investigations are facilitated or made altogether possible by it; moreover, it is very economical, particularly in engineering applications. This condensed review supplements and brings up to date the article on applications of radioactive materials in measurement and control engineering, published in this journal in Aug. 1967. The applications are briefly indicated under the following headings; tagging by radionuclides; activation analysis; isotope dilution; radiometric dating; radionuclides in biology and medicine; and localization diagnosis. Of direct interest to air pollution is the mention of measurements of dust emission with the aid of radionuclides. An economically important use of tagging by radionuclides is made in oil-refining process in which large amounts of costly catalysts are lost in the waste gases, thereby impairing the effectiveness of the reaction, which may also be adversely affected by aging of the remaining catalyst. The tagging method serves to determine the exact supplementary amount of catalyst required to maintain the effectiveness of the process, a short-lived radionuclide being used for monitoring the loss and aging of the catalyst and a long-lived one, as a standard of reference. The dispersal of impurities in air and in water form an emission source, also the emission of

solid, liquid particles, and gases into mine galleries or other enclosed spaces can be followed by this method. The activation analysis is used for identification and quantitative determination of trace elements.

260 APTIC NUMBER 16767

LeClare, P. C., A. J. Breslin, and L. D. Y. Ong
FACTORS AFFECTING THE ACCURACY OF AVERAGE DUST CONCENTRATION MEASUREMENTS. Am. Ind. Hyg. Assoc. J., 30(4):386-393, July-Aug. 1969. 9 refs.

To investigate the factors causing inaccuracies in estimating average dust concentrations, about 1100 dust samples were collected at a uranium plant over three days at various flow rates and time periods and analyzed statistically. The sampling precision error (a measure of reproducibility) for individual measurements of concentration was independent of dust concentration but inversely related to sampling period. In addition, measured dust concentrations were affected by flow rate. Frequency distributions of nearly all groups of consecutive samples met test criteria for both normality and log normality (that is, neither the hypothesis of normality nor that of log normality could be rejected on the basis of this test at the 10% level of significance). Coefficients of variation of the frequency distributions were in the range 0.1 to 0.8 and were dependent on sampling period. Variations in daily average concentrations were substantially greater among three fixed locations separated by intervals of 50 ft than at any single location. (Author's Abstract)

261 APTIC NUMBER 17204

Lindahl, B. O.
NEW METHOD FOR THE DETERMINATION OF SURFACE CONTAMINANTS CAUSED BY PARTICLE FALLOUT. (En ny metod for bestamning av ytfororeningar orsakade av partikelutfall). Text in Swedish. Svensk Farm. Tidskr., 73(28):840-847, 1969.

Air purity in workrooms is discussed where especially sensitive materials such as vacuum tubes, gyro instruments, relays, photographic emulsions, drugs, etc. are prepared. Previous efforts to determine contamination have depended on direct measurement of the number and size of airborne particles, with the greater weight being given to the number of smaller particles (0.5-5 micron). The problem is that larger particles (5-100 micron) often do the most damage to products. The method as discussed makes use of an automatic series of measurements with a PFO (particle fallout) photometer. The sample plate, after exposure in the work area, is illuminated with two intensive beams, both parallel to the surface of the plate and at right angles to one another. The particles on the plate scatter light in all directions, but the rays diffused upward at a right angle to the plate are detected with a photocell via appropriate optical instrumentation. A cadmium sulfide photocell is used, with a resistance and a time constant that vary with the intensity of illumination. The PFO photometer operates on the principle that small particles create special effects when bombarded with a light-source of a given wavelength. Calculation of particle size and quantity makes use of equations developed by Rayleigh, Gucker, and Rose.

262 APTIC NUMBER 16952

Luxl, F. C.
SAMPLING, ANALYZING AND CONTROL OF OXYGEN IN BOILER FLUE GAS. Preprint, American Society of Mechanical Engineers, New York, 8p., 1961. 2 refs. (Presented at the American Society of Mechanical Engineers, Winter Annual Meeting, New York, Nov. 26-Dec. 1, 1961.)

Information gathered from a series of studies was used to ascertain the best approach to the solution of the problem of sample validity in large ducts, based on 792 Orsat traverse analyses in 10 different ducts at 88 different loads, firing pulverized coal, oil, and gas. Nine probes were located in equal cross sectional areas of the duct in which the tests were conducted. The average performance of the three probes each located in the center of equal duct areas gave a higher assurance of being within a given accuracy than any of the best single probes. A single probe in the center of the duct was within 0.15% (accuracy of commercial O2 analyzers) 47% of the time, whereas the average of three probes in the center in one of each of three equal areas across the duct was within 0.15% O2 82% of the time. The maximum error that can be expected with one probe located in the center of the duct is 0.7% O2. The sampling analyzing equipment employed to monitor the flue gas for O2 in large ducts comprised of several probes, steam samplers, sample averaging unit, analyzer, and recorder. The application of sampling, analyzing equipment to automatic combustion control systems is schematically outlined.

263 APTIC NUMBER 16801

Marshall, B. S. and H. Wood
THE DETERMINATION OF TOTAL FLUORIDE IN AIR BY USING A MICRODIFFUSION TECHNIQUE. Analyst, 94(1119):493-499, June 1969. 14 refs.

A method is described for the determination of total fluoride, in the form of dust, fume or vapor, in industrial atmospheres; it is applicable over a wide range of fluoride concentrations. After collection on an alkali-impregnated filter-paper, the fluoride is released specifically in a micro-diffusion vessel and trapped by an alkaline coating on the inside of the lid of the vessel. The alkali is quantitatively transferred to a standard flask and the fluoride determined spectrophotometrically or visually with the lanthanum - alizarin fluorine blue reagent. The apparatus used is simple and the manipulation time required is less than 30 min per sample, although the microdiffusion stage requires a minimum of 16 hr (overnight) for completion. (Author's Abstract)

264 APTIC NUMBER 17281

Hasek, Vaclav
DETERMINATION OF BENZENE IN THE AIR. (Stanoveni benzeny v ovzdusi pracoviste). Text in Czech. Chemicky Prumysl (Prague), 19(44): 478-480, Oct. 1969. 10 refs.

The methods of colorimetry and polarography for determining the benzene content of air, both in the presence and absence of its homologues, were compared. The accuracy of both is the same when only benzene is present, and it decreases with the decreasing benzene concentration. In the presence of benzene homologues, the colorimetric method is more accurate, especially at low concentrations. Under the experimental conditions, the minimum measurable content of benzene was 2.5 micrograms/10 ml of air for the colorimetric method and 5 micrograms of benzene per 25 ml for the polarographic method.

265 APTIC NUMBER 15631

Masek, Vaclav
HYDROGEN CYANIDE EMISSION OF COKE OVEN PLANTS.
(Cyanwasserstoffemissionen aus Kokereien). Text in German.
Wasser Luft Betrieb, 13(10):380-382, Oct. 1969. 11 refs.

Three analytical methods are discussed for the determination of hydrogen cyanide in the atmosphere. In the first method, the gas sample is trapped in a sodium hydroxide solution. The cyanide ion reacts with chloramine T to form cyanogen chloride, which then forms a complex with pyridine. Upon hydrolysis, the pyridine ring splits and glutaconaldehyde is formed, which reacts with two molecules of 1-phenyl-3-methyl-5-pyrazolone to form a blue dye whose color intensity is proportional to the concentration of HCN. The second method is also based on absorption in sodium hydroxide solution. Glutaconaldehyde is condensed with dimedone to form a purple product whose color intensity is proportional to the HCN concentration. The third method, described previously by Goldman, likewise utilizes absorption of the gas sample in sodium hydroxide solution. With bromides cyanogen bromide is formed, which yields an orange complex upon reaction with benzidine dissolved in pyridine. The complex can be analyzed in the colorimeter. Comparison of the three methods shows that the last is quite accurate and uses chemicals which are easily available. Therefore, the Goldman method was used for measuring the HCN emitted by two cooling towers of a coke oven plant. It was found that the amount of cyanides in the atmosphere in the vicinity of both towers depended on the amount of water, on the temperature, and on the functioning of the ventilator. It was found that 10 to 15 kg HCN were emitted per hour when the ventilator was in operation.

266 APTIC NUMBER 16768

Masuda, Yoshito and Dietrich Hoffmann
QUANTITATIVE DETERMINATION OF 1-NAPHTHYLAMINE AND 2-NAPHTHYLAMINE IN CIGARETTE SMOKE. Anal. Chem., 41(4):650-651, April 1969. 12 refs.

A method is described for the analysis of 1-naphthylamine (I) and 2-naphthylamine (II) in cigarette smoke. The basic nonvolatiles of the smoke of 300 cigarettes are reacted with pentafluoropropionic anhydride and the resulting neutral components are chromatographed on Florisil. The concentrates of n-pentafluoropropionamides of I and II are analyzed by gas chromatography with an electron capture detector, which has a sensitivity limit of less than 1 ng. ^{14}C-labelled I and II served as internal standards. The mainstream smoke of an 85-mm U. S. nonfilter cigarette contained 27 ng of I and 22 ng of II. Although the identification of 2-naphthylamine in cigarette smoke represents the first isolation of a known bladder carcinogen from a non-occupational respiratory environment, no biological significance can as yet be attached to this finding. (Author's Abstract)

267 APTIC NUMBER 16748

May, H. E., H. A. Druett, and L. P. Packman
TOXICITY OF OPEN AIR TO A VARIETY OF MICROORGANISMS. Nature, 221(5186):1146-1147, March 22, 1969. 4 refs.

The discovery of a factor in the local open air which is toxic to E. coli and which probably arises from forms of atmospheric pollution has been described. Bacterial particles held on microthreads were exposed to the night-time open air. The loss of viability with length of exposure was measured. Results were compared with those obtained from exposure to clean, enclosed, laboratory air of the same temperature and humidity. The techniques employed and the results are discussed briefly.

268 APTIC NUMBER 16725

Maynard, J. B. and W. M. Sanders
DETERMINATION OF THE DETAILED HYDROCARBON COMPOSITION AND POTENTIAL ATMOSPHERIC REACTIVITY OF FULL-RANGE MOTOR GASOLINES. J. Air Pollution Control Assoc., 19(7):505-510, July 1969. 5 refs.

The quantitative data obtained with a capillary GLC method, which is used to determine the individual C3-C12 hydrocarbons in full-range motor gasolines, have been employed in a computer program to calculate the hydrocarbon composition of the vapor in equilibrium with a gasoline at that temperature. The method used for computation is similar to that previously described by McEwen, assuming the gasoline to behave as an ideal liquid. Also calculated is the potential atmospheric reactivity of this equilibrium vapor relative to that from other gasolines when specific reactivity weighting factors for the individual hydrocarbons are employed. Calculated total vapor-pressure data agree well with experimental Reid vapor-pressure data obtained for typical premium-grade gasolines. Definite differences were observed in the relative potential atmospheric reactivities calculated at 100 F for the equilibrium vapors from the test gasolines. (Author's Abstract)

269 APTIC NUMBER 17180

McKee, Herbert C.
CHARACTERIZATION OF PARTICULATE LEAD IN VEHICLE EXHAUST: EXPERIMENTAL TECHNIQUES. Environ. Sci. Technol., 4(3):252-253, March 1970. 5 refs. (Presented at the American Chemical Society Symposium 'Air Quality and Lead,' Minneapolis, Minn., April 14-15, 1969.)

An experimental system for studying motor vehicle exhaust is described that should provide valuable data on the contribution of engine exhaust to urban air pollution. The design of the system allows for isokinetic sampling, avoidance of water condensate, and other factors that make it difficult to obtain a truly representative sample. As indicated by propane tracer tests, the sampling system achieves uniform flow conditions and adequate mixing. However, the data obtained to date may be limited by material deposited by settling, since these particles fall immediately to the ground and are not an important source of air pollution. Future studies should concentrate on the smaller particles collected by the system. Further study is necessary to learn more about the lead content of exhaust particulate matter and about the acid, olefin, and carbonyl content of the high molecular weight organic fraction. If lead additives are to be drastically reduced, the aromatic content of a fuel has to be increased. Such an increase would increase the polynuclear aromatic content of the exhaust. Therefore, cutting down the lead content of fuel to reduce a suspected but unknown and unproved health hazard might increase another health hazard that is suspected, but equally unknown and unproved.

270 APTIC NUMBER 16729

Meddle, D. W., D. W. Radford, and R. Wood
A FIELD METHOD FOR THE DETERMINATION OF ORGANIC AROMATIC ISOCYANATES IN AIR. Analyst, 94(1118):369-376, May 1969. 7 refs.

A general field method is described for the determination in air of some organic aromatic isocyanates commonly used in industry. Collection of the isocyanate vapour or aerosol, or both, is effected in a mixture of hydrochloric acid and dimethylformamide. The amine produced is diazotised and coupled with N-1-naphthylethylenediamine to form a coloured complex, the intensity of which is compared with a set of permanent colour standards appropriate to the isocyanate being determined. The method enables the determination of up to 0.04 ppm v/v of isocyanate in air to be made. The procedure is simple and the time required for a complete analysis is about 35 minutes. (Author's Abstract)

271 APTIC NUMBER 17086

Mercer, T. T.
THE INTERPRETATION OF CASCADE IMPACTOR DATA. Am. Ind. Hyg. Assoc. J., 26(3):236-241, May-June 1965. 11 refs.

The cascade impactor is a valuable tool in inhalation toxicity studies because it permits a direct estimate of the mass distribution of an aerosol as a function of the equivalent diameter of the particle. The accuracy of the estimate is affected, however, by the non-ideal collection characteristics of real impactors and the errors inherent in the methods of interpreting impactor data. Two methods of interpretation are commonly used. In one, the stage constants of the impactor are effective cut-off diameters; it is assumed that a given stage collects all particles greater than, and no particles smaller than, its effective cut-off diameter. In the other, the stage constants are mass median diameters; it is assumed that the sample collected at a given stage always has the same mass median diameter. Errors in interpretation arise because stage constants of both types are functions of the mass distribution of the aerosol being used. In calculating the magnitude of these errors for an impactor having collection characteristics similar to those of the Casella impactor, effective cut-off diameters were found to be more reliable as stage constants than mass median diameters, but subject to error when the mass median equivalent diameter of an aerosol is below 3-5 micron. Accuracy of data interpretation can be improved by the use of impactors in which the collection efficiency curves of successive stages are displaced by a factor of about two. (Author summary modified)

272 APTIC NUMBER 17009

Mercer, W. B.
CALIBRATION OF COULTER COUNTERS FOR PARTICLES APPROXIMATELY 1 MICRON IN DIAMETER. Rev. Sci. Instr., 37(11):1515-1520, Nov. 1966. 20 refs.

The calibration of Coulter counters for use with particles having volumes two orders of magnitude smaller than red blood cells is discussed and a general method is presented for correcting the observed count for coincident passage of more than one particle. A linear relationship between particle volume and instrument response is confirmed for particles between 0.75 and 2.5 cu micron, but this relationship may not hold for smaller particles. The implicit assumption of negligible surface conductance in derivations of this relationship is found acceptable for polystyrene spheres of about one micron diameter. A potential source of error in calibration is identified and allowed for. (Author abstract modified)

273 APTIC NUMBER 17179

Mueller, P. K.
CHARACTERIZATION OF PARTICULATE LEAD IN VEHICLE EXHAUST - EXPERIMENTAL TECHNIQUES. Environ. Sci. Technol., 4(3):248-251, March 1970. 12 refs.

A substantial advance in the technology of sampling particles from motor vehicle exhaust is represented by a sampling tunnel that permits a complete evaluation of particulate emissions. This technique provides the means to obtain numerical guides relating lead emissions from cars to atmospheric lead contamination. The capability is now available to relate not only the quantity of lead additive to total emissions, but also to the particle size distribution and composition as a function of particle size. The validity of the numerical guides that should be developed will depend on how the information is treated. From the urban pollution viewpoint, it would be unwise to include in lead-bearing particle distributions the size groups which settle out quickly. The major air pollution load would come from particles about 10 micron or smaller. Particle size distribution can be conveniently expressed in terms of parameters derived from an assumption of log normality. However, the plotting of data on

log probability paper can easily lead to complacency about the assumption. Because the car exhaust aerosol is generated by both mechanical and chemical processes, it is also important to examine size distributions by means of histograms.

274 APTIC NUMBER 17219

Murray, James A. and Leland M. Vaughan
MEASURING PESTICIDE DRIFT AT DISTANCES TO FOUR MILES. J. Appl. Meteorol., 9(1):79-85, Feb. 1970. 10 refs.

Drift resulting from pesticide spray operations is an environmental contaminant and potential hazard. In order to quantitatively evaluate the relationship between a source and the extent of its contamination, it is necessary to measure the downwind amounts of pesticide that are still airborne as well as the deposition on the ground and foliage. Furthermore, it is also necessary to quantitatively characterize the droplet size parameters of these airborne and deposited amounts in order that the results of any given field test be extended for use in a general evaluation of the drift problem. A simple tracer technique to measure the required characteristics of the spray drift is described. The fluorescent particle (FP) spray tracing technique essentially consists of adding a known number of insoluble, micron-sized FP to the pesticide liquid prior to the spray operation. After spraying, the samples of artificial or natural surfaces are assessed. The number of FP grouped within an individual droplet pattern determines the droplet volume, and the total number of FP present represents the total mass of pesticide present in the sample. Also given are the results of field tests in which collections of droplets with volume median diameters less than 10 micron were obtained at distances up to 4 mi downwind. Airborne dosages as low as 10 to the minus 10th (gm-min/liter) were also measured by the FP spray technique and, may be used as an indicator of deposition.

275 APTIC NUMBER 17092

Nichols, P. N. R.
THE SIMPLE MODIFICATION OF A COMMERCIAL SULPHUR DIOXIDE METER FOR THE DETERMINATION OF OTHER ATMOSPHERIC POLLUTANTS. Chem. Ind. (London), 1654-1655, Sept. 26, 1964. 12 refs.

A modified commercial sulphur dioxide meter used for routine determination of contaminants in the atmosphere is described and illustrated. The design of the instrument suggests that, by a suitable choice of reagent and optical filter, it could be readily adapted for the measurement of other atmospheric pollutants. Among the pollutants of interest were hydrogen sulfide, nitrous fumes, fluoride, chloride, free chlorine, and organic chloro-compounds. Conditions under which all these pollutants were successfully determined, with an estimate of the sensitivity attained, are given in a table. Air suspected of contamination with sulfur dioxide is passed up a counter-current absorption column down which is flowing a starch-iodine reagent. The reagent is partially decolorized by the sulfur dioxide; the change in color is measured photometrically and related directly to the concentration of sulfur dioxide. The out-of-balance current produced from the two photocells is measured on a galvanometer.

276 APTIC NUMBER 17296

Ohkita, Toshiichi
MEASUREMENT OF AMINES, MERCAPTANS, AND ORGANIC SULFIDES IN AIR USING FILTER PAPER METHOD. (Roshi hoh o mochiita taiki chuh no amin, merukaputan, yuhki sarufaido no sokutei). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 5(12):703-708, Dec. 25, 1969. 9 refs.

The measurement of offensive gases is very difficult, because they can be felt in very low concentrations. A measurement method was developed by the use of gas chromatography. Collection of gases into a liquid cooled by dry ice has several faults, such as decreasing ventilation velocity and the collection of hydrocarbons, which exist as more than one offensive gas and prevent the measurement of them. The collection of offensive gases by a filter paper method in order to solve above problems was described. Gas is collected on filter paper with a reagent on it. After the sample is removed from the filter paper and concentrated; the gas is analyzed by gas chromatography. The collection method was studied using methylmercaptan, ethylmercaptan, dimethylmercaptan, and methylamine. These gases are emitted from petrochemical plants, pulp plants, and night soil treatment plants. The efficiencies of collection and recovery of the offensive gases using filters with reagents on them are almost 100 percent. Mercaptans, organic sulfides, and amines of about 1 ppb can be measured by this method.

277 APTIC NUMBER 17283

Okita, Toshiichi
AIR POLLUTION CONTROL RESEARCH IN U. S. A. (PART I). (Taiki osen o meguru Amerika no kenkyu taisei). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 6(1):38-48, Jan. 15, 1970.

Personal remarks and opinions of the approach the United States takes for air pollution control are presented. The U. S. appears to be concentrating on experiments of photochemical reactions in the atmosphere and on the advancement of air pollutant measurement methods. The general research trend is moving towards dry methods for lower costs in the labor force and for chemicals. Some meters and instruments currently devised and some measurement meters tested were a carbon monoxide meter capable of measuring CO densities below 1 ppm which can not be analyzed by the ordinary use of infrared rays, and a carbon dioxide recorder based on a Photometric Flame Detector. The simultaneous measurement of oxidants and ozone was also accomplished. Ozone measurement by use of rohdamine B is to be adapted as a standard meter after test results prove reliable and sufficient. Size distribution analysis in atmospheric corpuscles where size determines the extent of the effect on human bodies is also being tested. The technique can be applied to atmospheric corpuscles placed through a filter at the sixth cascade of an Anderson cascade impactor and collected in reinforced air stream. Other research activities and instruments were reported.

278 APTIC NUMBER 11780

Packard Bell Electronics Corp., Newbury Park, Calif., Space and Systems Div.
DESCRIPTION OF AEROMETRIC TELEMETERING AND DATA HANDLING SYSTEM. 29p., Feb. 10, 1967. (Prepared for the Department of Air Pollution Control, New York City, N. Y.)

A detailed description is given of an aerometric, telemetering and data handling system offered to the City of New York. The system consists of ten Auto-Met III remote terminals and one Auto-Met central station. The remote stations provide the functions of accepting the sensor outputs, electrically processing these outputs, sampling the processed signals and telemetering the resultant data to the central station. In addition, the remote station provides alarms and commands which are utilized in the operation of the system. The use of these two features are discussed. The central station is the nerve center of the system. Complete positive automatic and manual control of the system is provided by the station. The central station is equipped with a 100 wpm teleprinter, an eight-level, computer-compatible paper tape punch, and a special display map of the New York City area. The operations, functions, serviceability and flexibility of the system are explained with the aid of diagrams and charts. The expandability and modification of the system are discussed.

279 APTIC NUMBER 17135

Patterson, Gordon D., Jr. and M. G. Mellon
DETERMINATION OF SULFUR DIOXIDE BY COLOR CHANGING GELS. Anal. Chem., 24(10):1586-1590, Oct. 1952. 34 refs. (Presented at the American Chemical Society, Division of Analytical Chemistry, 121st Meeting, Buffalo, N. Y.)

Present methods of determining small amounts of atmospheric sulfur dioxide are inconvenient and time-consuming. Several granular gels are described which change color when exposed to 150-ml air samples containing 10 ppm of sulfur dioxide. The gel is placed in a glass tube and the air sample is drawn through the tube. Three methods of quantitative estimation may be used: the colors which appear on the various gels may be matched with standard color cards; the length of a colored column may be measured; or the sample volume necessary to produce a desired color or length of colored column may be observed. These gels provide a simple pocket-sized method for estimating physiologically dangerous concentrations of sulfur dioxide in the atmosphere. (Author abstract modified)

280 APTIC NUMBER 17111

Princen, L. H. and W. F. Kwolek
COINCIDENCE CORRECTIONS FOR PARTICLE SIZE DETERMINATIONS WITH THE COULTER COUNTER. Rev. Sci. Instr., 36(5):646-653, May 1965. 17 refs.

A new mathematical treatment is proposed for coincidence corrections necessary in determining particle size distribution in a Coulter counter. The method has the advantage of simplicity; since it assumes random intervals between particles, no series expansions or other simplifications are required. It takes into account both horizontal and vertical interactions between particles in the sensing volume. Expressions are developed relating the observed count, the real number of particles, the mean diameter, and the standard deviation of a distribution. Since the resulting equations are rather complex, a computer is recommended for their solution. (Author abstract modified)

281 APTIC NUMBER 17098

Radczewski, O. E.
FINE POWDERS (DUSTS) IN NATURE AND IN INDUSTRY, THEIR DETERMINATION AS CONTAMINANTS AND DETERMINATION OF FLUORINE COMPOUNDS IN THE AIR. (Feine Teilchen (Staeube) in Natur und Technik, ihre Bestimmung als Verunreinigungen und der Nachweis von Fluorverbindungen in der Luft). Text in German. Ber. Deut. Keram. Ges., 45(11):551-556, Nov. 1968. 9 refs.

The morphological significance of particles for their properties and the demonstration of industrial powders in the form of photographs and samples was presented. Electron diffraction is an important method because it allows a clear identification of extremely fine particles. Kaolinite and illite can be distinguished from each other or amorphous silica can be detected in Kaerlich clay. Contaminants in the air surrounding an aluminum factory were collected and electron-optically studied. Crystalline impurities in the atmosphere and the type and bonding of fluorine compounds in the exhausts of furnaces and kilns was also investigated with an electron-optical device. An unequivocal determination was made possible by examining cell sizes in the selected area of diffraction and by measuring the angles between the different lattice directions. The results showed that chlorides, sulfates, and fluorine compounds were present in the air above the North Sea and in the exhaust gases of an aluminum smelting furnace. (Author summary modified)

282 APTIC NUMBER 16734

Ramsden, A. R.
A MICROSCOPIC INVESTIGATION INTO THE FORMATION OF FLY-ASH DURING THE COMBUSTION OF A PULVERIZED BITUMINOUS COAL. Fuel, 48(2): 121-137, April 1969. 26 refs.

Fly ash and partly burnt coal particles were collected from the gas stream of the combustion chamber and flue of a technical-scale pulverized-coal-fired rig during the combustion of a bituminous coal. The particles were examined as collected by means of an electron microscope. The observations were supplemented by the use of a light microscope to study particles of the raw pulverized coal collected before they entered the rig, devolatilized particles collected from the combustion chamber, and fly ash particles collected from the precipitator. Various stages in the combustion of the coal and the formation of the fly ash were observed. Carbon black formed at an early stage in the combustion process, presumably through cracking of volatiles. Many devolatilized coal particles formed carbonaceous skeletal

structures, some formed vesicular carbonaceous spheres. Many of the fly ash particles collected by the precipitator were glassy spheres, indicating formation from a liquid phase. Observation suggested that small droplets of liquid ash coalesced to produce larger droplets. An analysis of the particle-size distribution in the fly ash collected by the precipitator indicated the presence of large numbers of the smallest particles and successively fewer of the larger particles. Such a distribution might be expected where the larger particles were derived through coalescence of the smaller--the process having stopped as soon as the liquid particles solidified on reaching cooler parts of the furnace. (Author's Abstract)

283 APTIC NUMBER 17094

Regener, Victor H.
ON A SENSITIVE METHOD FOR THE RECORDING OF ATMOSPHERIC OZONE. J. Geophys. Res., 65(12):3975-3977, Dec. 1960. 4 refs. (Presented at the 12th General Assembly of the IUGG, Helsinki, Finland, Aug. 4, 1960.)

A device which uses the luminescence of a dry substance in the presence of ozone for the automatic quantitive determination of minute concentrations of atmospheric ozone is described. The sensitivity of the device is extremely high and the response is instantaneous. Since there are no liquid chemicals, the method can be used at extreme heights in the atmosphere; it is equally applicable to the continuous monitoring of ozone near the earth's surface. A schematic diagram of the nitrogen dioxide insensitive ozone sonde in its present form is given. Operational procedures are described. A photograph of the original flight record obtained over New Mexico is shown. The flight reached a maximum altitude of 33.5 km. The chart shows a considerable amount of detail of the vertical ozone distribution in the troposphere. Above the tropopause, the ozone density begins to rise. There is a secondary ozone maximum at a height of 18 km during the ascent, as well as during the descent.

284 APTIC NUMBER 16723

Renshaw, Frank M., James M. Buchman, and James O. Pierce
THE USE OF MIDGET IMPINGERS AND MEMBRANE FILTERS FOR DETERMINING PARTICLE COUNTS. Am. Ind. Hyg. Assoc. J., 30(2):113-116, March-April, 1969. 7 refs.

Two techniques for sampling airborne dust, the midget impinger and the membrane filter, were compared in a preliminary, statistically designed laboratory study. An aerosol consisting of polystyrene latex particles of 1.099 microns in diameter was generated in a chamber from which simultaneous samples were collected by the two methods indicated. The samples of aerosol thus obtained were prepared by standard laboratory techniques and counted by light field microscopy. The particle counts obtained from both sampling techniques were statistically compared and a relationship derived. (Author's Abstract)

285 APTIC NUMBER 17007

Renzanigo, F.
THE ANALYTICAL DETERMINATION OF NOXIOUS PRODUCTS IN THE SMOKE OF COMBUSTION FROM A DOMESTIC HEATING PLANT. (Le determinazioni analitiche degli inquinanti dei fumi prodotti dalla combustione negli impianti di riscaldamento domestico). Text in Italian. Riv. Combust., 21(10):506-520, 1967. 11 refs. (Presented at the 22nd Congresso Nazionale dell'Associazione Termotecnica Italiana, Rome, Sept. 27-29, 1967.)

Methods of analysis of harmful constituents of flue gases from domestic heating plants differ from those employed in the study of pollutants of atmospheric air in that, besides being largely restricted to determinations of sulfur oxides and unburned solids, they usually include measurements of quantities required for evaluating the heating fuel or characterizing the operation of the heating plant. Among these, CO2-CO- and free-02-concentrations, temperature and optical density of the flue gas and its velocity at the sampling point, draft speed, combustion-chamber pressure, and fuel feed rate are discussed. The iodine and the oxygenated-water methods of SO2 and SO3 determination and their application are described in detail and methods of collection of representative samples of unburned solids from flue gas for their granulometric analysis are reviewed. The procedures used in granulometric tests of flue gases produced under different operating conditions of the heating plant, carried out at the Stazione Sperimentale peri Combustibili (Experimental Station for Fuels) are reported, in which the unburned solids were removed by a cyclone cleaner with a rock-wool filter and sorted with the aid of a special microscope. One sample obtained from flue gas with 0.115 grams/cu m of unburned solids, 87% of which were retained near the top of the rock-wool filter, had the following granulometric distribution (given here in the form ordered pairs (a;b), where a is particle size, in micron and b is the weight % of all particles of sizes less than a): (2.3;0.7) (3.3;1.2) (4.7;2.3) (6.6;3.6) (9.4;8.8) (13;18.1) (19;35.2) (27;58.7) (37;80.8) (53;100).

286 APTIC NUMBER 17048

Robinson, J. W., C. Woodward, D. M. Hailey, and H. M. Barnes
THE POTENTIAL DETECTION OF POLLUTANTS IN THE ATMOSPHERE USING A REMOTE SENSING DEVICE. Preprint, Am. Chem. Soc., Pittsburgh, Pa., Div. Water, Air Waste Chem., 7p., 1969. 4 refs. (Presented at the American Chemical Society, 158th National Meeting, Division of Water, Air, Waste Chemistry, New York, Sept. 1969.)

Tentative experimental results indicated the possibility of remote sensing by means of laser induced fluorescence for the qualitative and quantitative identification of gaseous air pollutants. The wavelength of the fluorescent bands of organic molecules, such as sulfur dioxide, nitrogen dioxide, and tetrathyl lead in the gas phase, coincided closely with the infrared absorption spectrum of the molecules, thereby permitting identification of each component by its spectral analysis. The intensity of the fluorescence was found to be proportional to the concentration of the fluorescing molecule present, thereby allowing a means for quantitative determination. In order for this method to become a reliable analytical tool, the effects caused by quenching and enhancement on the fluorescence intensity

must be examined. Further work is in progress.

287 APTIC NUMBER 17308

Rueb, Friedmund
MEASURING METHODS AND EQUIPMENT FOR AIR POLLUTION CONTROL. (Messverfahren und-geraete zur Reinhatung der Luft). Text in German. Wasser Luft Betrieb, 13(12):455-459, Dec. 1969.

Methods of measuring particulate and gaseous air pollutants are reviewed. The following are mentioned among dust measuring apparatus: the konimeter, for determining the number of dust particles per cu cm, characterized by high accuracy, convenient and reliable manipulation, as well as by certain and fast evaluation of the dust samples; the thermal precipitator for particle sizes between 5 and 20 micron; 'Microsorban' filters which trap even the finest aerosols while having a low flow resistance, and which dissolve in trichlorethylene or benzene; the portable dust measuring apparatus by Sartorius-Membran filter-GmbH in Goettingen for determining aerosol concentrations indoors and outdoors; the Klein dust meter in which the dust is trapped by cotton or fiberglass fabric filters and the cleaned air is passed through filter paper which is then burned, the weight of the dust trapped by both filters being referred to the measured volume of the dusty gas sample; and the 'Beta-Dustmeter,' which determines the amount of dust trapped by a filter by the concomitant attenuation of the beta radiation of a radioactive source, and is used for monitoring the performance of filtering installations as well as for control of the combustion processes in power, cement and metallurgical plants. The following are mentioned among smoke-density measuring apparatus: the smoke densimeter, which works by the 'two-beam method;' and the dust-concentration meter, which measures the attenuation of light traveling through a known thickness of smoke-or-dust-bearing air. Among gas-impurity measuring apparatus are mentioned the infrared gas analyzer used for determining carbon monoxide, carbon dioxide, ammonia, sulfur dioxide, hydrogen sulfide, and various hydrocarbon concentrations; the gas chromatograph and the reversion chromatograph; as well as the visibility-range meter. In most cases, the mode of operation of the measuring apparatus is described in detail.

288 APTIC NUMBER 17128

Saltzman, Bernard E.
PREPARATION AND ANALYSIS OF CALIBRATED LOW CONCENTRATIONS OF SIXTEEN TOXIC GASES. Anal. Chem., 33(8):1100-1112, 1961. 20 refs.

The development and testing of analytical methods for the accurate determination of low concentrations of various toxic gases are described. All-glass flow systems were preferred for the dilution of gases with purified air, since such systems avoid serious errors from surface adsorption or reaction with impurities. Several practical flow dilution systems are described and diagrammed, as well as an asbestos plug flowmeter which was found useful for metering flows varying from a few hundredths of a milliliter to a few milliliters per minute; motor-driven glass syringes can also be used for metering gas (and liquid) flows in these ranges, but have the disadvantage of intermittent operation. Rotameters are convenient for metering gas flows greater than 10 ml/min, but because of calibration difficulties are considered secondary rather than primary measuring devices. In an evaluation of chemical analytical methods, it was found that many of the methods available were based on assumptions derived from studies conducted either at high gas concentrations or in liquid solutions; various difficulties are encountered when such methods are critically tested at low concentrations. The methods finally selected were first tested for sensitivity for samples of reasonable size; results consistent with both sample volume and test gas concentration; adequate absorption efficienty with the available sampling equipment; and adequate stability of reagents and final solutions. The role of sampling absorption efficiency is developed mathematically, and midget sampling equipment described. Finally, methods are given for each of the following gases: ammonia, arsine, bromine, carbon dioxide, carbon monoxide, chlorine, chlorine dioxide, ethylene oxide, hydrogen chloride, hydrogen cyanide, hydrogen fluoride, monoethanolamine, nitric oxide, nitrogen dioxide, phosgene, and stibine.

289 APTIC NUMBER 17069

Sasawaki, Yukio and Syotaro Oka
GAS ANALYSER FOR SANITARY CONTROL OF ENVIRONMENTAL AIR. (Kankyo kuki no eisei kanriyo gasu bunsekikei). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(8):553-559, Sept. 15, 1966.

In an eight hr working day, a man inhales about twenty cu m of air. If the air contains one ppm of harmful gas, the total volume of harmful gas inhaled is twenty cu cm. The volume of the gas which the lungs absorb depends on the function of the lungs. The toxicity of a gas has a close connection with gas density and contact time; even oxygen is harmful above a certain density. Allowable values in a place of work are those densities which cause no harm to an individual working an eight hr day. The allowed values of about 128 substances, as decided by the American Medical Association, are tabulated. Exposure to air containing higher density values is hazardous, so gas must be continuously measured. The infrared absorption gas analyser Vras 1 has high sensitivity and can measure simultaneously carbon monoxide, carbon dioxide, ammonia, methyl alcohol, ethyl alcohol, and benzene. The electroconductive gas analyzer Ionoflux also has a high stability; it can measure hydrogen sulfide, sulfur dioxide, hydrogen cyanide, and phosgene. Oxygen has a strong paramagnetism and can be measured using this property. Oxygen-measuring apparatus is available in a ring chamber model or a cylinder chamber model. The former is called the Magnos 2; the latter, Magnos 5. Magnos 2 has high and wide sensitivity and is not disturbed by other components. Magnos 5 has high stability.

290 APTIC NUMBER 17309

Schecter, H. M. and R. G. Russ
THE RELATIONSHIP BETWEEN IMPRINT SIZE AND DROP DIAMETER FOR AN AIRBORNE DROP SAMPLER. J. Appl. Meteorol., 9(1):123-126, Feb. 1970. 6 refs.

The imprints resulting from the impact of precipitation drops on

thin aluminum foil in airborne drop samplers have been used to determine the size distribution of precipitation drops. A requirement in using such devices is a knowledge of the relationship between drop size and imprint diameter. These two parameters were investigated at speeds of 140 and 230 kt. The drop sampler consisted essentially of a supply roll of aluminum foil, a cylindrical drum around which the foil passes, and a take-up spool. The imprint was a function of the drop size and velocity at which the sampler was traveling. Calibration of the drop sampler was performed with a whirling arm. Drop generators located above the path of the sampler were used to produce uniform drops in the range 1-5 mm in diameter. Examination of the data obtained for the water drops indicated that the ratio of imprint to drop diameter was in the range 1.0-1.30.

291 APTIC NUMBER 16770

Sharkey, A. G., Jr., J. L. Shultz, T. Kessler, and R. A. Friedel
DETERMINING ORGANIC CONTAMINANTS. Res./Dev., 20(9):30-32, Sept. 1969. 14 refs.

An investigation of organic contaminants in airborne particulates and treated sewage has demonstrated the potential of the high-resolution mass spectrometer for expanding the knowledge of pollutants in air as well as in water supplies. High-resolution mass spectrometry can be used to investigate components volatile at 300 C in essentially total samples, providing molecular weights and elemental compositions of polynuclear aromatic hydrocarbons and other contaminants. High-resolution mass spectrometry can resolve and make precise mass assignments for components having the same nominal mass but differing in precise mass, e.g. methylacenaphthene and dibenzofuran have the same nominal mass of 168 but differ in precise mass by 0.03 atomic mass units.

292 APTIC NUMBER 16733

Short, G. D. and R. Young
CHARGE-TRANSFER CHROMATOGRAPHY OF POLYCYCLIC HYDROCARBONS. Analyst, 94(1117):259-261, April 1969. 10 refs.

It is shown that the chromatographic behavior of polycyclic hydrocarbons is modified by the relative strength of charge-transfer interactions when an insoluble electron acceptor, such as pyromellitic dianhydride, is dispersed in the solid phase. Improved separation of mixtures can be obtained, and brightly colored spots fluorescing in the visible region allow ready identification of components. (Author's Abstract)

293 APTIC NUMBER 16732

Sidor, Reinhard
A TECHNIQUE FOR THE SAMPLING AND ANALYSIS OF HALOGENATED HYDROCARBONS IN AIR. Am. Ind. Hyg. Assoc. J., 30(2):188-191, March-April, 1969. 3 refs.

The low Threshold Limit Values (TLV) of halogenated hydrocarbons tax the sensitivity of the conventional analytical techniques used for their quantitative analysis in air. A combustion tube technique using a phenol red absorbing solution is described which can detect one-tenth of the present TLV's of methyl iodine, methyl bromide and carbon tetrachloride and concentrations of one ppm or less of other halogenated hydrocarbons in a 10-liter air sample. (Author's Abstract)

294 APTIC NUMBER 17170

Stromberg, Lars Erik and Gunnar Widmark
QUALITATIVE DETERMINATION OF POLYAROMATIC HYDROCARBONS IN THE AIR NEAR GAS-WORKS RETORTS. J. Chromatog., 47(1):27-44, Feb. 1970. 23 refs.

An extract of air particulates from a gasworks was separated by two-dimensional thin-layer chromatography. Thirty-five different fractions were readily observed. Retention values, UV-visible absorption spectra, and mass spectra of 16 of the fractions were close to corresponding experimental data of standard polyaromatic hydrocarbons. For nonhydrogenated polyaromatic hydrocarbons, a linear relationship was observed between molecular weight and retention value in the first dimension of the thin-layer chromatographic system used. (Author abstract)

295 APTIC NUMBER 16975

Taylor, O. C., E. A. Cardiff, and J. D. Mersereau
APPARENT PHOTOSYNTHESIS AS A MEASURE OF AIR POLLUTION DAMAGE. J. Air Pollution Control Assoc., 15(4):171-173, April 1965. 16 refs.

A system is developed to automatically measure the effects of air pollutants in the ambient air on the rate of carbon dioxide exchange by intact leaves of citrus trees growing in the field, and a miniaturized system is designed, utilizing the same nondispersive infrared CO2 analyzer to study individually the effects of different concentrations of air pollutants on photosynthesis and respiration by plants. Deleterious effects indicated by a reduction in rate of CO2 fixation can be measured with the infrared CO2 analyzer. The instrument is capable of continuously recording changes of as little as one ppm of CO2 in a flowing air stream. The field apparatus for measuring CO2 exchange, the carbon dioxide exchange chamber for field studies, and the laboratory apparatus for measuring CO2 exchange on intact leaves are illustrated. Operational procedures are described. It is possible to study the effects of pollutants as they occur in the ambient atmosphere. The lucite cell through which air flow can be measured accurately and the internal reflector light source provide a uniform and measurable environment for the enclosed tree branches. The effects of specific toxicants can be studied individually with single leaves or small seedlings using a miniaturized CO2 measuring system in the laboratory.

296 APTIC NUMBER 17077

Terabe, Motoji and Masanobu Nagata
COMPARATIVE STUDY ON SULFATION RATES BY LEAD DIOXIDE CANDLE METHODS

USING VARIOUS KINDS OF SHELTERS. (Hisankaenho no yoru iou sankabutsu sokuteiho no hyojunka ni kansuru kenkyu). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 5(7):426-433, 1969. 7 refs.

Six different types of shelters were used to obtain an international relationship between the sulfation rates obtained by lead dioxide candle methods. The shelters used were the Hasegawa Shelter (Japan), NASN shelter (USA), Square Shelter (USA), B. S. Shelter (England), Kimoto Shelter (Japan), and Kawasaki Shelter (Japan). Data for 24 months from May 1966 to April 1968 at Isago, a commercial area, are presented. Data are also presented for the 12 months from May 1967 to April 1968 at Ohgi-machi, a heavy industrial area in Kawasaki, Japan. The ratios comparing the sulfation rate obtained by each type of shelter to standard values obtained by using the British Standard shelter were the Hasegawa shelter, 64%; NASN shelter, 88%; Square shelter, 78%; B. S. shelter, 100%; Kimoto shelter, 106%; and Kawasaki shelter, 80%. (Author abstract modified)

297 APTIC NUMBER 17279

Terabe, M.
PREPARATION OF STANDARD DILUTED GAS FOR CALIBRATION BY TEFLON PERMEATION TUBES. (Pamieision chubu ni yoru biryo hyojun-gasu no chosei-ho to oyo). Text in Japanese. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo), 6(7):18-21, 1969. 9 refs.

The phenomenon that a liquid gas (sulfur dioxide, nitrogen dioxide, propane, butane) permeates through the tube wall within a teflon tube at a constant rate was studied. The tube had an internal diameter of 0.062 in., a wall thickness of 0.012 in., and an internal temperature of 20.1 plus or minus 0.1 C. The permeation rate of 25 C was 0.58 micrograms/min/cm. By the use of these permeation tubes, a dynamic calibration of automatic SO2 or NO2 measuring instrument, an evaluation of the characteristics of SO2 monitoring instrument, and an adjustment of automatic NOX measuring instruments can be performed.

298 APTIC NUMBER 17037

Thoen, G. N. and D. C. Nicholson
INFRARED ANALYSIS OF KRAFT PULPING PROCESS GASES. Tappi, 53(2):224-226, Feb. 1970. 3 refs.

Investigations were undertaken to determine the suitability of an infrared spectrophotometer equipped with 10-m path length cells for analyzing kraft pulping gases. Components present in black-liquor recovery furnace, oxidation tower vent, lime kiln, evaporator, and digester relief and blow gases were identified positively without pretreatment of a mixture. However, infrared scanning still presents the problem of sample preparation and transport. Other methods such as coulometric titration or gas chromatography seem best suited for mill use.

299 APTIC NUMBER 17020

QUANTITATIVE DETERMINATION OF CARBON MONOXIDE IN THE AIR. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:19-29, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

Detailed instructions for determining carbon monoxide in the air of industrial premises cover the reagents and apparatus to be used and the air collecting and analyzing procedures to be followed. The method is based on the oxidation of carbon monoxide by iodic anhydride according to the following equation: 5CO + I2O5 yields 5CO2 + I2. The carbon dioxide formed is absorbed by a solution of barium hydroxide according to the reaction Ba(OH)2 + CO2 yields BaCO3 + H2O. Excess barium hydroxide is treated with hydrochloric acid. The sensitivity of the method is 1.4 gamma in a sample volume.

300 APTIC NUMBER 16829

Van Houten, R. and George Lee
A METHOD FOR THE COLLECTION OF AIR SAMPLES FOR ANALYSIS BY GAS CHROMATOGRAPHY. Am. Ind. Hyg. Assoc. J., 30(5):465-469, Sept.-Oct. 1969.

A method is described for the collection of air samples for solvent vapors for subsequent analysis by gas chromatograph. Through the use of special closures, it is possible to collect the samples in standard 4-oz French Square sample bottles. The samples can be transported for long distances and kept for as long as one month before analysis. The chromatographic technique is described. Extensive tests were conducted using a plastic-aluminum foil laminate and using Saran plastic for a seal. Saran gave the most satisfactory results. (Author's Abstract)

301 APTIC NUMBER 16109

Vertes, Michael A. and Harry G. Oswin
METHOD AND APPARATUS FOR DETECTING GAS. (Leesona Corp., Warwick, R. I.) U. S. Pat. 3,470,071. 5p., Sept. 30, 1969. 5 refs. (Appl. July 11, 1966, 15 claims).

The increasing industrial use of hydrogen cyanide derivatives, which emit only a faint odor, and the increasing military use of organophosphorous compounds require a rapid and portable gas detection system. Previously suggested electrolysis systems need a great deal of ancillary equipment for circulating the electrolyte and for scrubbing and circulating air. They are not conveniently manufactured. A detector for sensing these and other noxious gases is described that operates by spontaneous electrolysis and has a spontaneous alarm unit and a high electrode-electrolyte-gas contact area. It is easily manufactured in compact form. The detector comprises an anode, a cathode, an electrolyte, and an external circuit in which the warning signal connects the anode and cathode. The anode and cathode contain liquid impermeable and gas permeable polymer membranes coated at one surface with a catalytic layer. The catalytic layer of the cathode is electrochemically active with respect to the oxygen of its environment and invariant to the gas being detected, while the catalytic layer of the anode includes a material reactive to the gas to be detected. Each catalytic layer is in contact with the electrolyte and each

membrane, with the atmosphere. The electrolyte is an oxine; the polymer membranes, polytetrafluoroethylene; the catalytic layer of the anode, a mixture of hydrophobic polymer particles, silver or gold; and the catalytic layer of the cathode, a mixture of hydrophobic polymer particles and platinum black. The system is also capable for detecting hydrogen sulfide and hydrogen fluoride gases.

302 APTIC NUMBER 16781

Vogh, J. W.
NATURE OF ODOR COMPONENTS IN DIESEL EXHAUST. J. Air Pollution Control Assoc., 19(10):773-777, October 1969. 7 refs.

Offensive exhaust odors are characteristic of diesel engines. One problem in control and reduction of odor is lack of understanding of odorant sources and mode of formation. The solution of this problem depends on identification of the odorants so that study of their formation and control can be undertaken. A human panel performed odor assessments in studying raw and modified diesel exhaust and synthetic blends representing portions of diesel exhaust. Their assessments were used in determining odorant identity and quantitative contribution to exhaust odor. Low molecular weight aldehydes appear to contribute little to diesel odors. The sulfur and nitrogen oxides have been examined as odorants but of these apparently only nitrogen dioxide is a potential odor contributor. (Author's Abstract)

303 APTIC NUMBER 17047

Wallace, L. D., D. W. Kohlenberger, R. J. Joyce, R. T. Moore, M. E. Riddle, and J. A. McNulty
COMPARISON OF OXIDATIVE AND REDUCTIVE METHODS FOR THE MICROCOULOMETRIC DETERMINATIONS OF SULFUR IN HYDROCARBONS. Anal. Chem., 42(3):387-394, March 1970. 16 refs.

Two microcoulometric methods for the rapid determination of total sulfur in hydrocarbons were compared. In the oxidative method, sulfur as SO2 is coulometrically titrated with iodine. In the reductive method, sulfur as H2S is coulometrically titrated with Ag(+). For either method, duplicate determinations require only 10 minutes. Precision is in the order of plus or minus 0.2 ppm or plus or minus 3%, whichever is greater. The oxidative method is simpler to use and is low in nitrogen interference. However, it suffers from chlorine and heavy metals interference and nonstoichiometric conversion of sulfur to SO2. The reductive method is free from chlorine and heavy metal interference, is stoichiometric for most sulfur types, but suffers from nitrogen interference. The availability of both methods allows the determination of total sulfur in nearly every type of hydrocarbon sample encountered in the analytical laboratory. (Author abstract modified)

304 APTIC NUMBER 13463

Warmbt, Wolfgang
SULFUR DIOXIDE MEASUREMENTS WITH AN AMPEROMETRIC-IODOMETRIC RECORDING APPARATUS. (SO2-Messungen mit einer amperometrisch-jodometrischen Registrierapparatur.) Text in German. Z. Meteorol. (Berlin), 20(1-6):43-59, 1968. 30 refs.

A detailed description is given of a discontinuously recording automatic sampling device for determination of the SO2 content of atmospheric-iodometric method. The accuracy of the new device was checked by using laboratory air with known SO2 contents as well as by making parallel measurements of atmospheric air with the West and Gaeke method. The slightly lower SO2 values measured by the new device are ascribed to its sensitivity to the O3 content of air. This effect is negligible in most applications. The paper also contains extensive statistically evaluated data of measurements of the SO2 content of air, wind speed, and wind direction made in the periods from Aug. 1965 to July 1966 at the Wahnsdorf meteorological station near Dresden.

305 APTIC NUMBER 17023

Warren, Gary J. and Gordon Babcock
PORTABLE ETHYLENE CHEMILUMINESCENCE OZONE MONITOR. Rev. Sci. Instr., 41(2):280-282, Feb. 1970. 2 refs.

A portable monitor for ozone makes use of the chemiluminescence produced by ethylene gas in contact with ozone. The instrument comprises a mixing chamber, photomultiplier, nanoammeter, high voltage supply, pump, flowmeters, and ethylene supply. Instrument operation is simple: air containing ozone is drawn into the mixing chamber through an inner tube at 1 l/min. Ethylene is injected at 13 ml/min into an outer tube, and the two streams meet at the photomultiplier face. The monitor is easily calibrated by the buffered KI method. One serious problem associated with using the monitor around an accelerator is its sensitivity to radiation. A radiation field of 1 mR/h from a radium source, for example, produces a current equivalent to 6 ppbm. This trait can be used to some advantage by using a small source to check instrument operations. When low concentrations are being measured, the instrument must be shielded or a sample pulled through tubing from the radiation area.

306 APTIC NUMBER 16782

Williams, Frederick W. and Merle E. Umstead
DETERMINATION OF TRACE CONTAMINANTS IN AIR BY CONCENTRATING ON POROUS POLYMER BEADS. Anal. Chem., 40(14):2232-2234, Dec. 1968. 4 refs.

A method has been developed for concentrating gas samples at room temperature on porous polymer beads which eliminates the use of cold traps or cold columns, and given on-column injection. The gas sample is concentrated on the same column that is subsequently used for the gas chromatographic analysis. Used in connection with the microcoulometer it provides a satisfactory method for selective detection of chlorinated and brominated hydrocarbons in trace amounts in the air. The quantitative accuracy and precision of the on-column concentrating technique were determined by standards in the 1 and 2.5 ppm range.

307 APTIC NUMBER 17229

Wohlers, H. C. and W. E. Jackson
THE INDISPENSABLE EMISSION INVENTORY. Scientiae, 10 (691-692): 554-573, Nov./Dec. 1969. 32 refs.

The emission inventory is an indispensable tool for all air resources management programs. In this review, the advantages of an inventory are described and various inventory techniques are reviewed. Because of the lack of quantitative data on process losses from the large number of industrial operations in an urban area, a simplified approach was previously taken in calculating industrial emissions. In general, air pollution control agencies calculated emissions from fuel combustions only for large manufacturing operations and indirectly referred to typical process loss reports. More imaginative inventories relate emissions to energy consumption, calculating air pollutant concentrations from total tonnages emitted daily and the calculated air available for dilution purposes. Mathematical models, which predict the effects of pollutants from both single and multiple sources, are also an excellent tool for a thorough investigation of air pollution. One methodology calculates emissions on the basis of fuels consumed for space heating and process use. By assuming that industries which consume the greatest number of Btu would emit the greatest weight of pollutants, the method relates industrial energy requirements to combustion and process emissions. The procedure has many advantages for comparing industrial emissions of one area with another. It further provides total emission data for a minimum of effort and delineates the industrial groups having the most significant effect on air quality. Also discussed is a method for correlating published emission data with population.

308 APTIC NUMBER 16031

Zinky, William R.
HOLOGRAM CAMERA AND RECONSTRUCTION SYSTEM FOR ASSESSMENT OF EXPLOSIVELY GENERATED AEROSOLS. (FINAL REPORT). Technical Operations, Inc., Burlington, Mass. Contract DA-18-035-AMC-256(A), Rept. FO-B 65-90, 65p., Oct. 7, 1965. 30 refs.
CFSTI, DDC: AD 474534

This report describes the design and synthesis of a hologram camera and reconstruction system for measuring particle sizes from 5 to 1000 micron in explosively generated aerosols. The objective was to measure a volume of high velocity particles in situ. Theoretical resolution requirements and design details concerning 10 camera configurations with magnifications from 1 to 25X, capable of resolving particles from 3.5 to 1000 micron, are discussed. The design of a laser collimator to provide a 20 nsec illumination source is described. Aerosol sample volumes from 6.75 cu mm to 256 cu cm were reconstructed from individual photographs. The recorded disseminations demonstrate the feasibility of the hologram system for routine assessments of explosively generated aerosols, but further research is required to produce films and lenses especially adapted to the requirements of hologram photography. (Author abstract modified)

309 APTIC NUMBER 17045

Abbott, D. C., R. B. Harrison, J. O'G. Tatton, and J. Thomson
ORGANOCHLORINE PESTICIDES IN THE ATMOSPHERE. Nature, 211(6046): 259-261, July 16, 1966. 13 refs.

Gas-liquid column chromatographic analysis of London air samples collected in a Drechsel bottle indicated the presence of alpha-benzene hexachloride (BHC), gamma-BHC, dieldrin (HEOD), pp'-dichlorodiphenyl-dichloroethylene (DDEO), pp'-1,1-dichloro-2,2-bis(para-chlorophenyl)-ethane (TDE), and pp'-DDT. The highest concentrations found (in parts per 10 to the 12th power W/W) were 18-21 for Dieldrin and 5-11 for gamma-BHC. Although all levels are low, the presence in air of organochloride pesticides call for further and more detailed investigation. Confirmation of the identity of these residues by infrared spectroscopy or mass spectroscopy is advocated.

310 APTIC NUMBER 17046

Abbott, D. C., R. B. Harrison, J. O'G. Tatton, and J. Thomson
ORGANOCHLORINE PESTICIDES IN THE ATMOSPHERIC ENVIRONMENT. Nature, 208(5017):1317-1318, Dec. 25, 1965. 9 refs.

Rainwater was examined to determine pesticide residues in the atmospheric environment in London. Rain was collected in all-glass apparatus, with amber colored vessels to reduce the incidence of photochemical degradation. The organochlorine pesticides were determined by a gas-liquid chromatographic method using electron-capture detection and silicone and Apiezon columns. Because of the small amounts of rainwater collected monthly and the low level of pesticides found, it was not possible to confirm the results by an alternative technique. At the end of 6 months, residues were combined and examined by thin-layer chromatography on silica gel plates with hexane:acetone, 99:1, as the mobile phase. The presence of dieldrin, pp'-DDT, and the alpha and gamma isomers of benzene hexachloride (BHC) was confirmed. Insufficient quantities of the residues were available to confirm the presence of beta-BHC, pp'-TDE, and pp'-DDE. Individual rain water samples collected at a number of places in the British Isles were also examined. The presence of dieldrin, pp'-DDT, and the alpha and gamma isomers of BHC were confirmed by thin-layer chromatography. The results suggested that the atmosphere carries, either as vapor or by occlusion on dust particles, small amounts of the organochloride pesticides in common use in the United Kingdom and that they are scrubbed out by rain and snow. Preliminary results showed the presence of organochlorine pesticides in the range of 10-20 parts per million-million.

311 APTIC NUMBER 16976

Atkins, J. E.
CHANGES IN THE VISIBILITY CHARACTERISTICS AT MANCHESTER/RINGWAY AIRPORT. Meteorol. Mag. (London), 97(1151):172-174, June 1968. 1 ref.

Visibility observations recorded at the Manchester/Ringway Airport during the winter half-years (October to March) from 1949 to 1964 are expressed as precentages of total observations for wind speeds from 0 to 10 knots. The data show that since 1960, light winds are less likely to be accompanied by poor visibility. This tendency is apparent even for visibilities less than 440 yd. The changes are suggestive of the influence of smoke control in the Manchester area, but the evidence is not conclusive. Investigations are proposed that will take into account wind direction and the detailed timing of the introduction of smoke control devices.

312 APTIC NUMBER 16791

Atkins, P. R.
LEAD IN A SUBURBAN ENVIRONMENT. J. Air Pollution Control Assoc., 19(8):591-594, Aug. 1969. 14 refs.

The lead content of air, rainfall, and dry-fallout samples taken at several sites in Palo Alto, California, are reported and discussed. The high-speed high-density freeway traffic in the area appears to be the major source of lead pollution. The natural atmospheric cleansing processes of sedimentation and raindrop scavenging remove large quantities of lead particulate matter. It is suspected that nucleation occurs on the submicronic lead compound particles in the exhaust stream, producing droplets which may impact on the larger airborne particles. This could explain the wide range of size distributions reported in the literature as well as the large amounts of lead found in the samples analyzed. (Author's Abstract)

313 APTIC NUMBER 17018

Bondareva, E. N.
CONCENTRATION OF TARRY SUBSTANCES IN THE ATMOSPHERIC AIR IN THE VICINITY OF AN INDUSTRIAL COKE-GAS PLANT. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:89-92, 1963. 6 refs. (B. S. Levine, ed.)
CFSTI: 63-11570

Atmospheric concentrations of tarry substances (polynuclear aromatic hydrocarbons) in the vicinity of a coke-gas plant were determined by two methods: aspiration through an absorber containing nonfluorescent alcohol, and dust sedimentation followed by ether extraction. A total of 173 air samples was collected by the first method at 100-500 meters from the plant and a total of 34 samples by the second method at 500-100 meters. The concentrations were found to exceed those in the air of control points, with distribution of the substances markedly affected by changes of wind velocity and direction. At 500 meters from the plant and at wind velocity of 5-6 m/sec, two samples contained 0.34-0.37 cu m, which is equivalent to the concentrations normally found at a distance of 300 meters. The presence of 3,4-benzopyrene in the tarry substances was verified by spectral analysis. It was further found that a concentration as low as 0.001 mg/cu m produced shifts in the functional state of the central nervous system.

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APTIC NUMBER 17015

Bondareva, E. N. and V. Z. Yas'kova
HYGIENIC EVALUATION OF ATMOSPHERIC AIR POLLUTION IN THE VICINITY OF THE INDUSTRIAL PLANT 'KRASNYI KHIMIK'. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:115-119, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

Air around a chemical plant producing hydrochloric and sulfuric acid was analyzed for concentrations of sulfuric acid aerosol sulfur dioxide, and hydrochloric acid. The sulfuric acid concentrations of samples collected 1000 meters from the plant were 1300% times above allowable limits. Maximum HCL concentrations were found only 200 meters away, and were 1-12 times as great as allowable concentrations. At 500 and 1000 meters, HCL concentrations were minimum but always associated with SO2 and sulfuric acid. All air samples had high sulfur dioxide concentrations, particularly those collected in cold, cloudy weather and on foggy summer days. Under normal conditions, SO3 was present in concentrations from 0.0007-0.6 mg/cu m. Caged rats placed within 300 and 500 meter radii from the plant along the path of prevailing winds showed reduced cholinesterase activity and reduced vitamin C concentrations in the adrenals. There was a slight increase in vitamin C concentration in the liver and kidneys.

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APTIC NUMBER 17019

Bondareva, E. N.
HYGIENIC EVALUATION OF LOW CONCENTRATIONS OF NITROGEN OXIDES PRESENT IN ATMOSPHERIC AIR. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:98-101, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

Atmospheric concentrations of nitrogen oxides in Leningrad are compared with those in the vicinity of a sulfuric acid manufacturing plant located at the city boundary; the effect of the oxides on the central nervous system are discussed. In Leningrad, the concentrations ranged from 0.0001 to 0.02 mg/cu m, the latter found in samples taken from a thoroughfare with heavy motor traffic. Concentrations were considerably higher in the area of the chemical plant: at 500 meters from the plant, they ranged between 0.8 to 1.43 mg/cu m; at 100 meters, the concentration was 0.2 mg/cu m. The effect of nitrogen oxide inhalation was measured adaptometrically, i.e., by testing changes in eye sensitivity to dark adaptation. Concentrations between 0.15 and 0.3 mg/cu m produced no changes in the adaptation curve, indicating they had no effect on the function of the cerebral cortex. Concentrations of 0.5 mg/cu m produced a sharp increase in eye sensitivity to light, while a 1 mg/cu m concentration produced a slight lowering of the adaption curve 20-30 min after inhalation. The curve failed to return to normal even at the end of the experimental period. It is suggested that allowable atmospheric concentrations of nitrogen oxides be reduced from 0.05 to 0.3 mg/cu m.

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APTIC NUMBER 17101

Bosco, G., A. Grasso, and A. Grella
THIRD SERIES OF STUDIES ON THE PRESENCE OF POLYCYCLIC AROMATIC HYDROCARBONS IN THE ATMOSPHERIC DUST OF THE HISTORICAL QUARTER OF SIENA. (Terza serie di indagini sulla presenza di idrocarburi policiclici aromatici nel pulviscolo atmosferico del centro storico della citta di Siena). Text in Italian. Nuovi Ann. Igiene Microbiol. (Rome), 19(1):1-12, Jan.-Feb. 1968. 14 refs.

A third series of tests was carried out between December 1966 and May 1967 to determine the content of polycyclic aromatic hydrocarbons (PAH) in the atmospheric dust of Siena. The methodology is described in previous articles. Atmospheric dust was collected with a Staplex instrument, manufactured in Brooklyn, N. Y., on Schleicher and Schull #604 paper filters. Samples were taken on workdays between 11 am and 1 pm and between 5 pm and 7 pm, on the Via del Casato di Sotto and on the Via Pantaneto at the corner of Magalotti alley in downtown Siena, in each case at a height of 10 meters from the ground. Extractions were made at room temperature in a Soxhlet apparatus. Chromatographic separation was made on an aluminum oxide column, and the PAH was measured spectrophotometrically. The tabulated results show higher concentrations of the hydrocarbons during the winter months, with maximum values in December. Differences in the values as compared with the tests of previous years corresponds to the action of closing and partial reopening of the historic portion of Siena to motor traffic. The regulation was totally in force during the second series of tests, but an ordinance of September 1966 reopened several streets to traffic. During the time when the entire historic area was closed to motor traffic, the concentrations of most of the identified PAH showed a significant decrease. The reopening of part of the area caused a renewed increase in concentrations of these hydrocarbons.

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APTIC NUMBER 16271

Bouquiaux, J. and J. Grandjean
ATMOSPHERE POLLUTION, SMOKE AND SO2. Bull. Mens. Inst. Royal Meteoral. Belgique, 17p., June 1968. Translated from French and Flemish. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 17p., Sept. 26, 1969.

Tables and graphs of the average daily levels of smoke and SO2 pollution in Belgium are presented. The sampling apparatus consisted of a membranous electric pump that takes in about 2 cu m of air per day, a Whatman paper filter no. 1, a scrubber containing 50 ml of oxygenated water at a pH of 4.5, and a gas meter. The apparatus also included 8 filter-scrubber circuits that were automatically switched on each morning. Collection of samples was carried out once a week. Reflectometric analysis of the filter and acidometric testing of the liquid from the scrubber provided an average proportion of fumes and SO2 per cu m of air during the 24 hours of sampling. The network comprised 230 sampling stations. One hundred stations were located in the cities of Brussels, Antwerp, Liege, Charleroi, and Ghent; another 100 were located in less important cities and selected centers across the country; and 30 were located in meteorological stations equipped with anemometers. Analytical laboratories were located in the five large cities.

318 APTIC NUMBER 17058

Rose, John L. and Stanley Siebenberg
AIRBORNE LEAD AND CARBON MONOXIDE AT 45TH STREET, NEW YORK CITY.
Science, 167(3920):986-987, Feb. 1970. 4 refs.

Lead and carbon monoxide concentrations at a site 6 m above street level on East 45th Street were monitored for a ten-week period by a sequential tape recorder and a non-dispersive infrared analyzer, respectively. The average two-hr concentration between 8:00 am and 6:00 pm was 9.3 micrograms for lead and 18 ppm for carbon monoxide. Daily averages were 7.5 micrograms/cu m for lead and 13 ppm of carbon monoxide. Curves obtained by plotting the concentrations against traffic volume demonstrated strong correlations between lead and traffic and lead and carbon monoxide. During an overlapping 10-wk period, lead concentrations were also determined for a 12-m elevation in Central Park and a 30-m elevation on Second Avenue. The daily average for Central Park was 0.97 micrograms/cu m and for Second Avenue, 1.57 micrograms/cu m.

319 APTIC NUMBER 16684

Chovin, P.
AIR POLLUTION STUDIES IN PARIS AND OUTLYING DISTRICTS IN 1967. 1. OPERATION 'CARBON MONOXIDE', 2. OPERATION 'GARAGES', 3. OPERATION 'MONTPARNASSE, RAILROAD STATION', 4. OPERATION 'LOOP OF THE SEINE'. (Etudes de pollution atmospherique a Paris et dans les departements peripheriques en 1967. 1 - Operation 'Monoxyde de Carbone', 2 - Operation 'Garages', 3 - Operation 'Gare Montparnasse', 4 - Operation 'Boucle de la Seine'). Text in French. Prefecture de Police, Paris (France), Lab. Central, Rept. 58,337/D-PA, 80p., June 1968. 10 refs.

Results are reported of field studies of CO-pollution of air due to exhaust gases from motor vehicles in 1) central Paris, France (operation 'Carbon Monoxide') and 2) at air inlets and outlets of three underground parking garages (operation 'Garages'); 3) of air pollution by a variety of pollutants in the motor taxi hall of the new Montparnasse station in Paris (operation 'Gare Montparnasse'); as well as 4) of dust settling near the ground in the Seine river bend between Nanterre and Villeneuve-la-Garenne in the north-west part of the Departement de la Seine (operation 'Boucle de la Seine'). In 1), a total of 15,216 air samples were collected at 317 sites shown on the city map; 235 (1.54% of all) samples had a carbon monoxide content of more than 100 volume ppm at 129 of the sites. The average CO-concentration in the year 1967 was 25.9 volume ppm (a rising trend since 1960). In 2), in addition to the study of the effect of the presence of the garage ventilating system on the CO-concentration in its neighborhood, a search for the most representative locations of air sampling stations at different levels of an underground garage was undertaken. In 3), continuing a study begun in 1966, a laboratory van was stationed on July 29, 30, and 31, 1967 in the central part of the hall and the CO-, NO2- and NO-concentrations in air, and the Pb-content of dust collected in filters were determined analytically and the concentration of benzo-3,4pyrene in this dust was determined fluorospectroscopically. As a result of a modification of the originally installed ventilating system of the hall made after the 1966 tests, air pollution had diminished. In 4), continuing a study begun in 1959, dust from air was collected on 30 cm diameter settling dishes, at 22 sites. The material collected by a dish during one month consisted of water, insoluble dust particles (cinders and benzo-3,4pyrene) as well as water soluble dusts (sulfates, chlorides, and calcium compounds). The amounts of these were determined and referred to an area of 100 sq m per month. The average monthly total amounts of dust collected at the 22 sites are shown. The results are evaluated statistically and are presented in the form of monthly averages and histograms. At one site the amounts of benzo-3,4pyrene were consistently exceptionally high; 7 new settling dishes installed at sites close to and surrounding a suspected source had four times higher amounts of benzo-3,4pyrene than any of the 21 other sites. This pinpointed a charcoal and asphalt processing plant as the most probable source.

320 APTIC NUMBER 16994

Chovin, P.
STUDIES OF ATMOSPHERIC POLLUTION IN THE DEPARTMENT OF THE SEINE IN 1966. 1. OPERATION 'CARBON MONOXIDE', 2. TWO OPERATIONS 'GARAGES', 3. STUDIES OF ANTI-SMOKE ADDITIVES, 4. OPERATION 'LOOP OF THE SEINE'. (Etudes de pollution atmospherique dans le departement de la Seine en 1966. 1-Operation 'Oxyde de carbone', 2-Deux operations 'Garages', 3-Etudes sur les additifs anti-fumees, 4-Operation 'Boucle de la Seine'). Text in French. Prefecture de Police, Paris (France), Lab. Central, Rept. no. 56, 275/D-PA., 74p, April 1967. 10 refs.

Results are reported of field studies of carbon monoxide pollution of air due to exhaust gases from motor vehicles in 1) central Paris (operation 'Carbon Monoxide'); 2) at a public garage with six underground levels and in an automobile repair shop (operation 'Garages'); 3) in field and test-stand studies of two anti-smoke additives, to diesel-engine fuels; as well as 4) field studies of dust settling near the ground in the Seine river bend between Nanterre and Villeneuve-la-Garenne in the north-west part of the Departement de la Seine. In 1), a total of 15,203 air samples were collected at 317 sites; 247 (1.6% of all) samples had a CO-content of more than 100 volume ppm at 105 of the sites. The average CO-concentration in the year 1966 was 24.6 volume ppm (a rising trend since 1960). In 2), in both places despite the existing ventilating equipment or equipment to catch the exhaust gas at the test stands, the atmosphere had become particularly polluted in the public garage. The variation of the CO-concentration in air with time was determined at the six underground levels. In the repair shop, the CO-concentration both in air and in the blood of the employees before and after work was measured. All mechanics contained some CO in their blood. In 3), a series of air samples were collected at three locations before any additives were being added to the fuel of the autobus Diesel engines. Then samples were collected at the same locations and under the same conditions after the engines were operating with a fuel with 0.25 volume % of an anti-smoke additive containing Ba salts. The maxiaum concentration of soluble Ba compounds in the air samples was determined. In addition, two Diesel engines were tested, without and with fuel additives. Either anti-smoke additive lowers the rate of smoke emission. They appear to have no effect on the emission of other pollutants, such as CO, NOx, aldehydes, oxidizers, etc. Ba from

the additives is present in the exhaust gases in concentrations of 1.5 to 3.0 mg of Ba metal/cu m of exhaust gas, when there are 0.5 volume % of an additive in the fuel. In 4), continuing a study begun in 1959, dust from air was collected on 30 cm diameter settling dishes at 22 sites. At one site, the amounts of benzo-3,4 pyrene were consistently exceptionally high; 7 new settling dishes, installed at sites close to and surrounding a suspected source, had four times higher amounts of benzo-3,4 pyrene than any of the 21 other sites. This pinpointed a charcoal and asphalt processing plant as the most probable source.

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APTIC NUMBER 16971

Cleno, G. B.
SOME CONSTITUENTS OF CITY SMOKE. Tetrahedron, vol. 23:2389-2393, April-June 1967. 5 refs.

In view of the complimentary action between atmospheric smoke and cigarette smoke in producing cancer in mice, the former was further investigated, and a number of aromatic hydrocarbons were isolated and identified. The neutral portion of atmospheric soot, extracted with light petroleum, was nitrogen free. Chromatography of the complex mixture yielded a number of hydrocarbons from which the crystalline 1,3,5-trinitrobenzene complexes were prepared. It was found experimentally that aromatic hydrocarbons are eluted from alumina in the following order: napthalene, fluorene, anthracene, phenanthrene, pyrene, 1,2- and 3,4-benzpyrenes, chrysene, 1,12-benzperylene, and picence. So far, pyrene, 3-methylpyrene, 1,2-benzpyrene, triphenylene, chrysene, and 1,12-benzperylene have been isolated and identified and 3,4-benzpyrene has been identified.

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APTIC NUMBER 17075

Dubrovina, Z. V.
ACID-ALKALINE REACTIONS OF SUSPENDED DUST COLLECTED BY THE ASPIRATION METHOD. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:105-109, 1963. 7 refs. (B. S. Levine, ed.)
CFSTI: 63-11570

Gas electrodes were used to determine the pH of cement, talc, and street dust collected in small glass cyclinders by the aspiration method. Values were established for different dust concentrations and different dilutions and varieties of dust; studies were also made to determine the effect of time on the pH. The average pH values were as follows: cement, 9.05; talc, 6.20; and street dust, 7.40. Under identical determination conditions, the pH reaction depended on dust concentration. In the case of cement dust, the pH was inversely proportional to its concentration. The pH of cement dust determined six days or more after collection was lower than expected, suggesting that determinations should be made not later than 24 hours after sampling. In all cases, lower dust dilutions yielded higher pH values. Laboratory tests were verified by determinations of dust samples from the area of a cement plant and from a residential area. The data obtained show that dust in the proximity of the plant was of strong alkaline reaction, while that collected 500 meters away had a reduced pH. Dust from the residential section, which weighed less than 1 mg, had a neutral pH.

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APTIC NUMBER 16814

Eggleton, A. E. J.
THE CHEMICAL COMPOSITION OF ATMOSPHERIC AEROSOLS ON TEES-SIDE AND ITS RELATION TO VISIBILITY. Atmos. Environ., 3(3):355-372, May 1969. 13 refs.

Approximately 100 high-volume filter samples collected in the Tees area during June to Oct. 1967 have been analyzed for some 20 inorganic components. Ammonium and sulfate ions were major components of all the samples analyzed comprising 65% of the total soluble ion content and were present in proportions close to that of ammonium sulfate. The visibility recorded at one of the stations showed good correlation with the sulfate and ammonium ion concentration, less good with smoke and virtually no correlation with sodium ion. Although such a correlation does not necessarily imply a causal relationship between visibility and the concentrations of ammonium and sulfate ions, calculation shows that they account for a substantial portion of the loss of visibility. Observations on a day of "a typical Tees-side Mist" showed very high levels of ammonium and sulfate of 33 micrograms/cu m and 130 micrograms/cu m repsectively for a 24 hr sample and the concentrations during the mist period were probably more than twice as great as these figures. Results from the other stations indicated the presence of a strong source in the Tees area itself. Theoretical calculations indicate that most of the visibility loss on this day could be ascribed to the (NH4)2 SO4. (NH4)2 SO4 is believed to arise from the oxidation of SO2 in the atmosphere in the presence of ammonia gas. Apart from industrial sources, NH3 may be given off from the soil by decay of nitrogenous material, from the combustion of coal or from untreated sewage. The levels of (NH4)2 SO4 found on most days at Tees-side during the sampling period were not much different from those observed at AERE where there is no possibility of local industrial sources, so that non-industrial sources must also make a substantial contribution at Tees-side. (Author's Abstract)

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APTIC NUMBER 17106

Endo, Ryosaku, Tetsutaro Kohgo, Tatsunori Oyake, Naoki Sugawara, and Toshiko Sakamoto
STUDIES ON THE URBAN ATMOSPHERIC POLLUTION BY AUTOMOTIVE EXHAUST GAS IN THE CITIES OF HOKKAIDO. (PART 2). ON THE INVESTIGATION IN OTARU CITY. (Hokkaido no toshi ni okeru jidosha haiki gasu no taiki osen ni tsuite (dai 2 ho) otarushi ni okeru chosa kekka ni tsuite). Text in Japanese. Hokkaido-ritsu Eisei Kenkyushoho, no. 18:143-149, June 1968. 11 refs.

The urban atmospheric pollution caused by automotive exhaust gas in Otaru was investigated. The measurement of dusts, carbon monoxide, sulfur dioxide, nitric oxide, nitrogen dioxide, lead, and 3,4-benzopyrene and the number of vehicles were carried out at 4 places along the roadside. The road at points A and B was narrow, at points C and D, it was wide. It was cloudy and calm at points A and B, and was clear and windy at points C and D. More vehicles passed by points A and B, with a maximum of 2000/hr at B.

The concentration of all the pollutants were higher at point B with the exception of SO2. The maximum concentrations were listed. It was concluded that the atmosphere at the point B was more contaminated than points in the cities of Kushiro and Asahikawa which were previously investigated. (Author abstract modified)

325 APTIC NUMBER 17270

Faraone, Piero
BACTERIAL AIR POLLUTION. (L'inquinamento batterico dell'aria). Text in Italian. Acqua Ind., 11(8):14-18, Nov. 1969. 17 refs.

The studies of various Russian, American, and Italian authors on the bacterial content of indoor and outdoor air is summarized and explained in nontechnical terms. Data on the bacterial content of various indoor situations and that of the outdoor atmosphere of various Italian cities are given in tabulated form. Russian and American studies have confirmed that low humidity conditions favor the transportation of bacteria-laden dust to the upper atmosphere, and their survival there. Indoor emissions of persons with communicable diseases can contain not only bacteria but certain 'feeder gases' from which they can draw sustenance. The indoor rate of movement of bacteria is quite slow (1cm in 10 minutes). The vitality of microbes is influenced by many factors: sunlight, temperature, humidity, chemical agents, competition from other microorganisms, nature of the material on which they come to rest, ability to practice saprophytism, and length of exposure to unfavorable conditions. Various indoor hygienic measures are summarized: practical construction and furnishing of homes and other buildings; proper cleaning and disinfection; avoidance of overcrowding; proper use of space; regulation of relative humidity, temperature; air conditioning.

326 APTIC NUMBER 17307

Ferguson, William S., John J. Griffin, and Edward D. Goldberg
ATMOSPHERIC DUSTS FROM THE NORTH PACIFIC - A SHORT NOTE ON A LONG-RANGE EOLIAN TRANSPORT. J. Geophys. Res., 75(6):1137-1139, Feb. 20, 1970. 11 refs.

Dust samples were collected on a ship between San Diego, California and Juneau, Alaska. Illite was the dominant clay mineral in dust samples, which was in agreement with the distributions across the North Pacific. The concentrations of montmorillonite, chlorite, and kaolinite were also similar to those found in the North Pacific sediments. Mica, chlorite, plagioclase, and quartz were ubiquitous in the silt-size fraction. The dust content was 0.5 to 1.0 micrograms/cu m. A possible reason for the low values was the frequent wash-out of the airborne dust by rains associated with storm conditions in the North Pacific during April. Perhaps the dust concentrations found over the North Pacific were low values rather than average ones for the month of April in 1969, because the storminess associated with the jet axis was more intense than normal, indicating unfavorable conditions for long-range dust transport. The clay mineral assemblages were in agreement with the concept of an eolian transport of solids from the arid areas of Europe and Asia to the marine environment.

327 APTIC NUMBER 17221

Filippov, V. L. and S. O. Mirumyants
VARIABILITY OF THE CONCENTRATION OF CO IN STABLE WINTER HAZE. Bull. Acad. Sci. USSR, Phys. Atmos. Oceans (English translation from Russian of: Izv. Akad. Nauk SSSR, Fiz. Atmosfery i okeana), 5(9):556-557, Sept. 1969. 8 refs.

Spectra of atmospheric transparency in the 3.95-5.6 micron wavelength region were obtained in the fall under conditions of different meteorological visibility and in the winter under conditions of stable haze as well as conditions of rain mixed with snow. Examination of the spectra for the fall period showed that the value of the concentration of carbon monoxide was in agreement with a previously reported concentration (an order of magnitude less than .00013%). Under conditions of stable winter haze, the content of carbon monoxide varied greatly, increasing by more than an order of magnitude with a decrease of meteorological visibility up to 1.8 km. The dependence on carbon monoxide on visibility is presented in a graph. No relationship was observed between temperature and carbon monoxide concentrations.

328 APTIC NUMBER 17183

Fujie, Kiyoko
GAS CHROMATOGRAPHIC ANALYSIS OF POLYCYCLIC AROMATIC HYDROCARBONS ASSOCIATED WITH PARTICULATES IN OSAKA AIR. (Taikichu takanhokozoku taukasuiso no gasukuromatogurafi niyoru sokutei). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 3(2): 126-133, 1969. 13 refs.

Polycyclic aromatic hydrocarbons associated with particulates in Osaka air were determined by gas chromatography. Samples were collected at four sites in the city from June 1968 to February 1969. Concentrations of 16 polycyclic aromatic hydrocarbons in 59 samples were obtained. According to the results of the determinations, the annual average concentration of the hydrocarbons was approximately 370-500 micrograms/1000 cu m air and approximately 1300-1600 micrograms/g particulates. Average 3,4-benzopyrene concentrations were approximately 30-60 micrograms/1000 cu m air and approximately 100-180 micrograms/g particulates. Seasonal variations were found in both the amount of polycyclic hydrocarbons and 3,4-benzopyrene; their concentrations in winter were almost double what they were in summer. No remarkable annual variation was found in air pollution due to automobile exhaust gas. Bap/b(ghi)P and Bap/Cor ratios are given for urban air and automobile exhaust gas. They are considered presumable indicators of air pollution sources. (Author abstract modified)

329 APTIC NUMBER 17064

Hayakawa, Kazuya, Shigeo Shimogata, and Takeshi Kubo
FIELD SURVEY OF AIR POLLUTION FOR CITY ENVIRONMENT, 1ST REPORT -- AN EXAMPLE AT OHTA-KU, TOKYO. (Toshi kankyo no tameno taiki osen no kosatsu, Dai 1 poh, Tokyoto Ohtaku no ichirei). Text in Japanese. Kukichowa Eisei Kogaku (J. Japan Soc. Heating Air Conditioning Sanitary Engrs.), 43(9):815-828, Sept. 25, 1969.

3 refs.

Sulfur dioxide and smoke dust were measured at six points in Ohta-ku, Tokyo. An attempt was made to compare the SO2 figures obtained with its diffusion distribution. The year-long survey employed an SO2 sampler, dust meter, hygrometer, and anemometer. The results are presented in graphs showing monthly and daily fluctuations of sulfurous gas and smoke; to eliminate factors which influenced daily fluctuations, the average fluctuation was determined. The procedure employed in the statistical analysis of the quantitative information was to prepare histograms showing variations of the sample standard in comparison with the fluctuation distribution of quantitative data. There are three ways to conduct a theoretical study of air pollution distribution. One is experimental research employing an actual meteorological survey of emission gas diffusion. The second is to employ the wind tunnel method, and the third is to rely on an assessment of a diffusion formula. This study takes the third approach, using actual figures of sulfurous gas and smoke dust. General remarks derived from the statistical analysis of the quantitative data indicate that annual average density of sulfurous gas is 0.073 ppm which far exceeds the environmental standard of 0.05 ppm; highest density is found from April to September.

330 APTIC NUMBER 17242

Inouye, Rikita, Heibachiro Yazawa, Yuji Watanabe, Akira Nakamura, Satoshi Nakajima, Daijiro Kita, Koji Tanaka, and Takafumi Masuda
AN ANALYSIS OF THE AIR POLLUTION IN AN URBAN BUILT UP AREA. (Tokidanbo ni yoru toshitaikiosenkiko nitsuiteno ichikaiseki). Text in Japanese. Eisei Kogaku (J. Dept. Sanit. Eng. Hokkaido Univ.), no. 17:11-20, March 7, 1970. 1 ref.

A statistical analysis was made of the relationship between the concentration of sulfur oxides in the area of Sapporo City and significant meteorological parameters. The center city area of 42.5 square km was chosen for measurements and the fuel consumption in this area during 6 winter months was surveyed by a statistical sampling. In this area, meteorological factors such as temperature and wind speed were measured. The concentration of sulfur oxides was continuously monitored by an electroconductivity method. The meteorological factors concerned with atmospheric diffusion potential, such as wind speed and atmospheric stability, were found to have no significant relationship with the sulfur oxides concentration. Ambient temperature alone had a predominant effect on the concentration of sulfur oxides in the air. This was explained by the fact that the emission rate of sulfur oxides was related to the ambient air temperature. A regression equation between the daily fuel consumption for building boilers and the ambient air temperature was obtained in a linear form. A functional relationship between sulfur oxides concentration, wind speeds, and air temperature at this point was also obtained. The maximum concentration was twice as high as the daily average, with that on holidays about 70% as high. It is concluded that in Sapporo City, pollutants do not stay in the atmosphere for long periods; that is, the pollution source is located in the immediate neighborhood.

331 APTIC NUMBER 16927

Kanitz, S.
POSSIBLE FORMATION OF 'PHOTOCHEMICAL SMOG' IN ITALY: SYNTHESIS AND DETERMINATION OF PEROXYACYLNITRATES IN THE LABORATORY AND IN THE OUTDOOR AIR OF GENOA. (Possibilita di formazione dello 'smog fotochimico' in Italia: sintesi e determinazione di perossiacilnitrati in laboratorio e nella atmosfera libera a Genova). Text in Italian. Giorn. Igiene Med. Prevent. (Genoa), 8(3):324-334, May-June 1967. 19 refs.

An experiment was conducted with gas chromatography to determine the possible presence of peroxyacetylnitrate (PAN) in the atmosphere above Genoa. The presence of this substance would indicate the existence of secondary air pollutants of the photochemical type, such as are found in Los Angeles smog. The PAN used as a standard was synthesized by photolysis from a mixture of ethyl nitrite and oxygen. Isolation of the PAN by gas chromatography took place in a Teflon column filled with 5% Carbowax 400. Samples of the atmosphere were taken on sunny days, with an absence of wind and a relative humidity below 40%, at the edge of a heavily traveled and highly congested highway. A second experiment checked the possibility of obtaining PAN by irradiating the exhaust of an 8-cycle motor of European manufacture and using high-test gasoline. Irradiation took place in a 2-liter pyrex tube, using a mercury vapor UV lamp for periods of as much as 90 minutes. Experimental results revealed that the maximum level of PAN measured at Genoa is 0.33 ppb, which represents about 1/100 of the maximum to be found in such a location as Riverside, California. Analysis of the irradiated exhaust fumes also revealed the presence of PAN. Some of the chromatograms showed peaks that were strongly suspected of representing peroxypropylnitrate and peroxybutylnitrate, but this was not absolutely confirmed.

332 APTIC NUMBER 16835

Kertesz-Saringer, M., J. Morik, and Z. Morlin
ON THE ATMOSPHERIC BENZO(3-4)PYRENE POLLUTION IN BUDAPEST.
Atmos. Environ., 3(4):417-422, July 1969. 4 refs.

The atmospheric benzo(3-4)pyrene pollution in Budapest was investigated with column and thin layer chromatography followed by fluorescence and absorption spectrophotometry. A heavy snowfall in 1963 made collection of snow samples possible, and the results obtained by this type of sampling were compared with the results from dust and soot samples. The snow samples yielded higher values (3.12 microgram/g) than the sedimenting dust (2.22 microgram/g). The effect of motor vehicle traffic was also investigated by collecting samples from busy traffic points. (Author's Abstract)

333 APTIC NUMBER 16304

Koerner, Hans-Joachim
MEASURES TO CONSERVE AIR PURITY IN HESSE. (Massnahmen zur Luftreinhaltung in Hessen). Text in German. Wasser, Luft Betrieb, no. (7):479-481, 1966. 3 refs.

At the end of the year 1965, 438 Bergerhoff dust sedimentation

measuring units were in operation in the state of Hesse , of which 98 measure emission in the immediate vicinity of certain emission sources and 340 background concentrations. In 1965, a total of 4060 samples was obtained for laboratory analysis. The detailed results are tabulated. As indicated, 14% of the 42 sampling sites measuring the background concentration (those which were erected after 7/1/1965 are not included) had an average annual dust concentration above the maximum allowable concentration set for residential areas. At 2.7% of the stations, the allowable annual concentration set for industrial areas was exceeded. The set limits are mainly exceeded in Kassel, in the southern and southeastern suburbs of Wiesbaden, Frankfort/Main, and Wetzlar. It is planned to expand the measurement grid in these cities to obtain more detailed information on dust pollution. Comparison with similar measurements in the Ruhr area shows that the allowable concentration for industrial areas is exceeded there at 31.3% of the measuring stations (vs 2.7% in Hesse).

334 APTIC NUMBER 16839

Landau, Emanuel, Raymond Smith, and David A. Lynn
CARBON MONOXIDE AND LEAD - AN ENVIRONMENTAL APPRAISAL. J. Air Pollution Control Assoc., 19(9):684-689, Sept. 1969. 7 refs.

The present status of ambient levels of lead and carbon monoxide in the air to which the population may be exposed, the concentrations that exist, and the variations over time and space are discussed. The sources of atmospheric Pb are emissions of Pb as fumes and dusts from industries using Pb and from the combustion of gasoline or other fuels containing Pb. Automobile emissions are the major source of Pb. Data obtained from the National Air Surveillance Network and from a Three-City Study (Cincinnati, Los Angeles, and Philadelphia) are discussed in some detail. Automobile emissions are also a major source of CO in the ambient air. The Continuous Air Monitoring Program has measured CO, NO, NO2, SO2, total hydrocarbons, and total oxidant in the downtown of six selected cities. The data relating to CO are discussed. Because of the common source Pb and CO values in the atmosphere tend to behave in a similar manner. Diurnal variations in these two pollutants show a pattern related to motor vehicle traffic flow. (A discussion related to this topic is presented by George D. Clayton).

335 APTIC NUMBER 16787

Lawrence, E. N.
HIGH VALUES OF ATMOSPHERIC POLLUTION IN SUMMER AT KEW AND THE ASSOCIATED WEATHER. Atmos. Environ., 3(2):123-133, March 1969. 8 refs.

The meteorological conditions associated with the higher values of daily mean concentration of atmospheric sulfur dioxide at Kew Observatory during a period of five summers (1960-64) are discussed. High daily mean values of pollution during summer, in contrast with winter, do not occur especially in the central high pressure areas of anticyclones but with average or somewhat above-average pressure such as is found in the vicinity of shallow depressions or near cols. (Author's Abstract)

336 APTIC NUMBER 16058

AIR POLLUTION STUDY - MUSKEGON, MICHIGAN METROPOLITAN AREA. Preprint, Michigan Dept. of Public Health, Lansing, Div. of Occupational Health, 24p., 1968 (7). 1 ref.

An emission inventory type air pollution study was conducted in the Muskegon metropolitan area to collect data on the amounts and character of industrial contaminants. The type of process being conducted, production rates, fuel consumption, the nature of air cleaning equipment, and the total quantities of pollutants emitted were investigated. Seventy-three industrial establishments were found to emit gaseous and particulate contaminants amounting to 106 tons/day, excluding combustion products. Combustion of coal was a serious source of air pollution: eleven plants emitted a total of 417 tons/day of combustion products to the atmosphere. Combustion of natural gas accounted for the emission of 3.6 tons/day of contaminants. No estimates of pollution from domestic heating appliances and domestic and industrial open or incineration type burning were made. Motor vehicles were believed to account for the release of 20 tons/day of hydrocarbons into the atmosphere as compared to 38 tons/day from refineries and bulk fuel stations and 3.2 tons/day from engine testing. Excessive dust, dense brown metallic oxide plumes, dense black plumes, characteristic odors, and a light to dense haze were observed. Manifestations of economic loss included car surface damage, accelerated corrosion of other metallic surfaces, discoloration of buildings, and increased everyday housekeeping costs. However, climatology is generally beneficial in terms of dispersion and removal of pollutants in the area. Inversions are infrequent and short-lived. Proper application and use of cleaning equipment should eliminate much of the pollution emanating from industrial processing and industrial combustion sources. It is recommended that an air pollution control board be established and that emissions of solid particles, sulfur dioxide, smoke, hydrocarbon vapors, and open burning of refuse and leaves be regulated by law.

337 APTIC NUMBER 17312

Mitani, I., T. Seki, and H. Aso
ON THE AIR POLLUTION IN THE INDUSTRIAL AREA OF THE NORTHEASTERN COAST OF TOKYO BAY (3RD REPORT). RECENT STATUS OF AIR POLLUTION IN ICHIHARA. (Keiyo rinkai kogyochitai no taiki osen (Dai 3 po) - Ichihara chiku no taiki osen no genjo). Text in Japanese. Kenkyu Jiho (J. Meteorol. Res.), 21(7):437-444, Dec. 20, 1967.

Data obtained in a year-long field survey at Ichihara City was statistically analyzed. The city, located on the northwest shore of Tokyo Bay and at a distance of 15 km from central Tokyo, is the site of several petrochemical industries and thermal power plants which depend predominantly on heavy oil for energy sources; air pollution problems in the area are centered on sulfur oxides. The highest concentration of the oxides is found in the daytime. Maximum daily variations are 2 to 5 times higher than the minimum nighttime variations. The highest monthly densities are found in the winter, when the concentration of sulfur dioxide frequently exceeds 0.2 ppm. This value is reached infrequently from June to September, when winds presumably aid in the dispersion of major pollutants over the area. An analysis of the

relationship between sulfur oxides' density and wind direction and wind speed also reflects and reinforces this conclusion. Moreover, the reverse holds for areas which have reverse wind direction and wind speed during summer. An analysis of the relationship of sulfur oxides density to atmospheric pressure shows that periods of high density in fall and winter are related to fronts of high atmospheric pressure.

338 APTIC NUMBER 17324

Miyazaki, Hiroshi, Kunio Ui, and Yasuyuki Motonaga
THE SURVEY OF AIR POLLUTION CAUSED BY THE REFINERY STACK GAS. (Endo haigasu no shuhen taiki eno eikyo chosa). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 3(2):77-85, Feb. 15, 1967. 9 refs.

In a survey of atmospheric pollution in the vicinity of an oil refinery, data was obtained both when the plant was in operation and out of operation. The oil refinery has seven chimneys, two of which belong to boilers used for the power plant. The remainder are connected to the refining process boiler. At the time of the survey, there were no other plants in the area. The survey covered 32 days, including 16 days of work suspension. A significant finding was that the average density of sulfur oxides was not lower when the plant was not operating. The concentration of pollutants in the area is apparently strongly influenced by wind direction.

339 APTIC NUMBER 17102

Morik, Jozsef
MEASUREMENT OF AIR POLLUTION IN HUNGARIAN INDUSTRIAL CENTERS. (A levego szennyezettsegenek merteke ipari telepuleseinken). Text in Hungarian. Magy. Tud. Akad. Orvosi Tud. Oszt. Kozlemen., 18(3/4):417-424, 1967.

Budapest has by far the most serious air pollution problems of any Hungarian industrial center as shown by large scale measurements over a 10-15 year period. Data is presented in the form of 7 tables, compiled both by the author and by other Hungarian authors, based on studies of air pollution in Hungarian metropolitan areas. Eleven such areas, including Budapest, almost consistently show values in excess of the legally permissible limits of dust, carbon particles, and sulfur dioxide. In some of these communities, there are also excesses of such dangerous substances as chromium, phenol, beryllium, copper, silicon, and manganese. In the industrial sectors of the big cities, in addition to soot, dust, and sulfur compounds resulting chiefly from some type of combustion, one also finds a noticeable content of ammonia, the nitrogen oxides, chlorine gas, and organic chlorine compounds such as chlorphenol. The stench of some of these organic compounds, particularly the chlorinated hydrocarbons, is noticeable as much as 15-20 kilometers away. Measurements of fluorine pollution in the vicinity of the Varpalata aluminum plant gave figures of 0.097 mg of fluorine per cu meter at 2 km distance from the plant, and 0.67 mg at a distance of 20 meters. The permissible limit is 0.01.

340 APTIC NUMBER 17103

Morik, Jozsef
POLLUTION OF METROPOLITAN AIR. (A varosi levego szennyezettsege). Text in Hungarian. Idojaras (Budapest), no. 4:220-226, 1967. 29 refs.

Air pollution of urban areas from the use of coal as a fuel is increasing. Compared with earlier values of 10 tons dust/sq km per year, the average is now several hundred tons. Airborne dust amounts to about 0.1 mg/cu meter, but can be as high as 1.0 mg in some places. Sulfur dioxide does not exceed one mg per cubic meter thus far, but is important in the formation of smog. Urban air contains steadily increasing amounts of carbon monoxide and tar derivatives. The chief offender in Hungary is industry, and the air pollution problems in other Hungarian cities are minor compared with those of Budapest. Each year, the city receives an average of 171 tons/sq km of dust, and the average amount suspended in the air averages 0.29 mg/sq meter. The effect of acid gas emissions, composed mostly of hydrocarbons, is noticeable in an extensive area surrounding the capital city, and measured readings considerably beyond the permitted levels have been recorded. Total sulfur contamination is 21.4 mg/100 hours, and the average sulfur dioxide concentration is 0.68 mg/cu meter. Concentrations of chlorine and chlorides have reached figures as high as 0.47 mg/cu meter. The average concentration of carbon dioxide is 0.42 volume %. In the most polluted industrial areas, the average pollution from soot is 1.11 mg/cu meter. These figures represent a 50% increase in soot pollution and a 40% increase in sulfur pollution over the figures of 25 years ago.

341 APTIC NUMBER 17240

Odaira, Toshio
REVIEW ON AIR POLLUTANTS CONCENTRATIONS AND THEIR CORRELATIONS ON THE BASIS OF AIR POLLUTION PHENOMENA. (Osengensho karamita taikiosen shitsunodo to sogokan no kankei). Text in Japanese. Taiki Osen Kenkyu (J Japan, Soc., Air Pollution), 3(3):167-178, Dec. 1, 1969. 3 refs.

Data on pollutant concentrations, atmospheric temperature at an elevation of 107 m, and wind direction and speed, obtained in Tokyo during August and December, 1967, were statistically analyzed. Although concentrations of various air pollutants can be determined in accordance with combinations of factors such as weather, topography, source intensity, etc, the effects of the latter were not analyzed concretely. Pollutants which showed similar pollution patterns (concentration frequencies) were grouped together. Four groups were found: particulates, carbon monoxide and nitric oxide, sulfur dioxide and nitrogen dioxide, and ozone. It was assumed that the pollution pattern varied from group to group. Particulate concentration was monitored by a digital dust meter, a tape light reflection index, and a tape light transmission index. Particulate concentration was twice as high in winter as in summer, and unaffected by wind direction. The CO concentration was three times as high in winter as in summer. A correlation was found between SO2 and NO2 concentrations and between CO and NO. The oxidant showed a concentration pattern different from the other three groups. It is concluded that it is possible to forecast air pollution by applying multiregressjon techniques or a simultaneous equation of

two-step estimation to analyzers of sources, local weather, pressure distribution, etc.

342 APTIC NUMBER 17286

Odaira, Toshio and Mitsuru Udagawa
SOME EXAMPLES OF LARGE-AREA AIR POLLUTION IN LATE SPRING. (Banshun niokeru koiki taikiosen jirei no shokai). Text in Japanese. Taiki Osen Nyusu (Air Pollution News), no. 54:6-12, Sept. 1969.

Two measures are stipulated in the Japanese air pollution law: alarm and warning. Since an alarm was given for the first time on February 5, 1965, 42 cases have been recorded which included 6 alarms in Metropolitan Tokyo. Few cases occurred in and after April. The alarm continued for 29 hours from May 9-10 in 1969. When this happened, there was a high atmospheric pressure to the south of the Japanese Islands, and a low atmospheric pressure above the sea to the east of Hokkaido. Wind blew from the south in the daytime. In Zyoto and Kasuya, the concentration of sulfur dioxide was high (above 0.3 ppm) at ground level during the two days. The high SO2 concentration in Tokyo was at the height of 125 meters and 225 meters, gradually decreasing to the ground because of winds from the south. It did not happen at night, even with wind from the south. After the high concentration of SO2 was recorded, an increase in the concentration of SO2 was reported over 23 wards about an hour later. As the data at 7 AM on May 10th indicates, the high concentration of SO2 at Zyoto was caused by winds from the east. It was concluded that the air pollution structure is not only affected by the source and situations around it, but also by wide vertical structures, such as atmospheric pressure, temperature, velocity and wind direction.

343 APTIC NUMBER 16841

Peterson, C. M., H. J. Paulus, and G. H. Foley
THE NUMBER-SIZE DISTRIBUTION OF ATMOSPHERIC PARTICLES DURING TEMPERATURE INVERSIONS. J. Air Pollution Control Assoc., 19(10): 795-801, Oct. 1969. 8 refs.

Instruments capable of measuring in situ numbers of particles within specific size ranges covering a particle-diameter spectrum of approximately 0.001 - 10 microns have been employed to continuously monitor the concentration and size-distribution of atmospheric aerosols. The monitoring site was a television tower located on the boundary between Minneapolis and St. Paul, Minnesota. Air samples were drawn from 70, 170, and 500 feet above ground level and analyzed with optical, electrical, and condensation particle counters to obtain a number-size distribution within the 0.001 - 10 micron size range. In addition to the measurement of particle number and size, several micrometeorological parameters were simultaneously monitored. Particle number-size distributions which were measured during periods of temperature inversion are reported and discussed in this paper. (Author's Abstract)

344 APTIC NUMBER 17285

DENSITY OF SULFUR OXIDES IN ATMOSPHERE. (Iou sankabutsu no taiki chu nodo). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 5(11):670-679, Nov. 25, 1969. 32 refs.

Sulfur dioxide measurements near the point sources in steam power plants, petroleum refineries, and blast furnaces are described. The effect of sulfur oxides on the acidity of rainwater and granular substances in the atmosphere are also discussed. The density of sulfur dioxide in air was continuously measured in 8 cities in America. The sulfur dioxide concentration in Los Angeles and San Francisco was lower than in the East. The data were arranged by time intervals into mean values for five time periods: 1 hour, 8 hours, 1 day, 1 month, and 1 year. The data were also arranged into several terms, which included maximum value in a year, geometric average, standard geometric deviation, maximum and minimum value, and efficient data percentage. The measuring period was from 1962 to 1967. Air pollution was strongest in cities in the following order: Chicago, Philadelphia, Washington, St. Louis, Cincinnati, Los Angeles, Denver, and San Francisco. The plants emitting large quantities of sulfur dioxide were described as the point sources. The density changes were determined according to the change in wind, production quantity, and temperature. The relationship between sulfur dioxide density and sulfur trioxide density was also described. Sulfur trioxide density became high on a foggy day.

345 APTIC NUMBER 16844

Schlichting, H. E., Jr.
THE IMPORTANCE OF AIRBORNE ALGAE AND PROTOZOA. J. Air Pollution Control Assoc., 19(12):946-951, Dec. 1969. 15 refs.

Membrane filters, bubblers, and exposed culture media were used to sample viable algae and protozoa from the atmosphere in Michigan, Texas, and North Carolina from 1956 to 1967. Aerial algae and protozoa were most abundant and diverse in North Central Texas, 0 - 8 cells/cu ft, less abundant and diverse in Michigan, 0 - 1.8 cells/cu ft. Other significant research from 1910 to 1968 is reviewed. A total of 187 taxa of algae and protozoa has been sampled and cultured through this period. The importance of airborne algae and protozoa to man is shown as related to allergies, radioactivity, clogging of air filters, an aid in determining the origin of hurricanes and other storms and adding to our understanding of the dispersal of these microorganisms throughout the world. (Author's Abstract)

346 APTIC NUMBER 17096

Selegean, Elena, M. Cucu, C. Anghelescu, I. Ardeleanu, C. Botezatu, N. Dargenta, A. Lucinescu, Olimpia Popa, Zanfira Stanescu, and N. Manea
INVESTIGATIONS ON THE OXIDIZING POTENTIAL OF THE AIR IN 4 TOWNS IN THE SOCIALIST REPUBLIC OF RUMANIA. (Cercetari cu privire la potentialul oxidant al aerului din 4 orase din Republica Socialista Romania). Text in Rumanian. Igiena (Bucharest), 15(9):533-539, 1966. 16 refs.

The oxidizing potential of the air in 4 towns in Rumania was investigated over a period of 3 years. In 2 towns with large oil refineries, high O3 concentrations were found, particularly on sunny, summer days. This was probably due to the photochemical oxidation of the pollution emitted into the atmosphere. (Author summary modified)

347 APTIC NUMBER 17156

Smith, R. M. and Page C. Twiss
EXTENSIVE GAGING OF DUST DEPOSITION RATES. Trans. Kansas Acad. Sci., 68(2):311-321, Aug. 31, 1965. 16 refs.

Dust settling from the atmosphere over prolonged periods was continuously trapped at several widely separated locations. Sites were intended to provide some indication of the magnitude of dust influx from remote locations and to determine whether deposition rates indicate patterns related to geographic location, climate, superficial earth material, or land use. A likely influence considered in the initial site selections was the dust bowl region of southwestern Kansas, southeastern Colorado, northwestern Oklahoma, and northwestern Texas. The relatively similar rates of deposition for a number of months when the atmosphere appeared relatively free of dust suggested that specific sites may be characterized by a basal rate of influx providing a lower bound from which increased rates caused by special or unusual influences may be measured. Deposition of dust ranged from a maximum of 46 pounds per acre at Hays, Kansas, where the soil surface is well covered with grass and local soil blowing was not evident, to a minimum of 20 pounds per acre at Manhattan, Kansas, with no noticeable dust in the air. Dust quality varied from month to month and among locations. The absence of feldspars and micas in the silt and sand and of 14 A clays in the less than 2 micron fraction were consistent characteristics of dust in Manhattan and Hays. The absence of definite shades of red appeared to eliminate the red beds region of south central Kansas and north central Oklahoma as likely sources of the dust influx. The pH of raw dust was between 7.0-8.5, suggesting essential base saturation of colloids and some free alkaline earth carbonates. Dispersion with Calgon resulted in percentages of clay ranging from 16-65%. Median silt plus sand diameters were in the silt or fine range between 7-30 micron with some particles 100 micron or greater in diameter. More intensive gauging to measure selected local influences may contribute to the understanding of soil genesis, soil renewal, and the origin of loess.

348 APTIC NUMBER 16843

Stephens, Edgar R. and Frank R. Burleson
DISTRIBUTION OF LIGHT HYDROCARBONS IN AMBIENT AIR. J. Air Pollution Control Assoc., 19(12):929-936, Dec. 1969. 10 refs.

The diversity of hydrocarbons which are present in ambient polluted air provide a potentially rich source of information concerning the nature of this type of pollution. Measurements of the relative amounts of various hydrocarbons can be correlated with the various possible sources. Since hydrocarbon reactivities vary widely it is also possible to estimate the extent to which various individual hydrocarbons have reacted. Except for samples taken deliberately near sources of hydrocarbon pollution these air samples invariably resemble auto exhaust with an addition of natural gas and of C3-C5 paraffins which resemble gasoline vapor. Samples taken in industrial areas and near the smoke plume from a brush fire showed distinctive differences in composition. During the smog season in the fall of 1968 good data were obtained of "typical" or "representative" samples of light, medium and heavy smog. These show the expected depletion of more reactive hydrocarbons in a much more convincing way than before. By comparing these distributions with composition in unreacted samples and by making use of data from bottle irradiations, it was possible to estimate the contribution of the various hydrocarbons in terms of "amount reacted." The amounts of higher hydrocarbons present and reacted were also estimated from gasoline composition. (Author's Abstract)

349 APTIC NUMBER 17068

Tokyo Inst. of Technology (Japan), Kiyoura Lab.
ABATEMENT OF AIR POLLUTION I - (1) SULPHUR DIOXIDE. (Ayusan haigasu ni yoru kogai bojo ho). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 1(1):55-58, April 15, 1965.

Sulfur- or sulfide-containing matter produces sulfurous acid gas when heated by air or oxygen. There is a danger of air pollution occurring if the density of sulfurous acid gas in air exceeds 0.3 ppm for long periods. Katz and his staff studied damage from sulfurous acid gas emitted by a zinc and lead refinery at Trail B. C. to woods in the basin of Columbia River. They found smoke pollution most prevalent in the spring. Smoke pollution occurs immediately if gas density is high. According to Zimmerman, the permissible limit of sulfurous acid gas is not 0.3 but 0.7 ppm. Holmes and his members experimentally determined that sulfuric acid mists from 30 to 65 ppm did little damage to alfalfa, sugar, beets, etc., even after four hours. For four days in December, 1950, London was covered by a thick smog with a sulfurous acid gas content of 0.6 to 0.8 ppm; the death rate was nine times higher than usual. Sulfur dioxide is a colorless gas that is catalytically oxidized to sulfuric acid. Sulfuric acid is sharply reduced in water; sulfur dioxide melts in cold water.

350 APTIC NUMBER 17016

Turzhetskii, K. I.
BACTERIAL POPULATION OF AIR SURROUNDING TYPICAL LIVING QUARTERS IN AN INDUSTRIAL REGION. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:125-129, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

In a bacterial investigation of air in an industrial city, air samples were collected from old and new residential areas by the aspiration method and by exposing open petri plates. Counts of air samples collected by the aspiration method showed that the bacterial content of the air in the old district was lowest in February, March, and April (100-500 counts per ml of air) and highest in May, June, and September (900-2000). Significant differences were observed in the bacterial content of air from an enclosed yard and air from the yard's open entrance. None of the

samples collected from the new areahad a count exceeding 500 microorganisms, and samples from different sites did not show the wide fluctuations found in counts in the first area. Counts obtained by the open plate method showed even more clearly that the number of bacteria per ml of air was less in the new area than in the old. Results of either method showed that the air in the new section contained more aerobic spore-formers than the air of the old section, where pigmented bacteria and mold spores were more numerous. These findings indicate that the bacterial population of the new section comes from the soil, while the microbial air pollution in the old section is the result of household conditions.

351 APTIC NUMBER 17241

Wakamatsu, Shinzi, Yuzi Watanabe, and Heihachiro Yazawa
CHARACTERISTIC FEATURES OF CONTINUOUS AIR QUALITY DATA BY STATISTICAL METHOD (PART I). (Taiki osen nodo no tokeikaiseki (I)). Text in Japanese. Eisei Kogaku (J. Dept. Sanit. Eng. Hokkaido Univ.), no. 17:1-10, March 7, 1970. 8 refs.

Data on sulfur dioxide concentrations in six Japanese cities were statistically analyzed to derive the average concentration. Four factors were considered to be related to the occurrence of air pollution: source strength, distribution of sources, climate, and topographical effects. The accumulated frequency distribution calculated from the mean hourly values, was used to analyze the data from the cities. A difference between weekdays and holidays was seen in the distribution in urban areas but not in industrial areas. When summer and winter distributions in an urban area were compared, no seasonal differences were noted, indicating a uniform increase in the exhaust rate of pollutants. In an industrial area, a seasonal difference in distribution was found. Distribution was also found in a four-year period, probably because of changes in the structure of the city. A quantitive analysis of the data is also presented. It is concluded that the effect of source location on distribution should be studied in future, together with a functional form of pollutant distribution.

352 APTIC NUMBER 17181

Wang, Victor and John H. Shaw
VARIATIONS IN THE ABUNDANCE OF ATMOSPHERIC CARBON MONOXIDE NEAR THE GROUND. J. Appl. Meteorol., 9(1):180-182, Feb. 1970. 5 refs.

The abundance of carbon monoxide in ground level air was measured during the summer over a seven-week period in a relatively open area surrounded by a low-density suburb and a small number of light manufacturing plants. Radiant flux from a Nernst filament was passed through an evacuated spectrometer and collected by a PbSe detector. The measured abundances are given as a function of local time. Increased abundances observed near 0800 and 1700 local daylight time corresponded to times of peak vehicular activity. High abundances between 0800 and 0900 occurred with winds from the south. On most days, carbon monoxide concentrations decreased noticeably in the early afternoon. The decrease was less obvious when daily average concentrations were lower than usual and during precipitations. On the latter occasions, the carbon monoxide content remained high, suggesting that locally produced carbon monoxide is distributed vertically by convection on a summer afternoon. Convection presumably decreased in the late evening.

353 APTIC NUMBER 16977

Wiggett, P. J.
THE YEAR-TO-YEAR VARIATION OF THE FREQUENCY OF FOG AT LONDON (HEATHROW) AIRPORT. Meteorol. Mag. (London), vol. 93:305-308, 1964. 3 refs.

Mean monthly and yearly records of visibility (from less than 45 to 1090 yd) at Heathrow Airport are presented for the years 1946-1963. The frequency of fog in the 200-yd range and up has decreased significantly over the years, while the frequency of thick fog (visibility less than 22 yd) has remained virtually unchanged. The improvement in the higher ranges is seen as primarily the result of the reduction of smoke pollution in London, though the possibility that it is in part the result of some synoptic or climatic factor cannot be ignored.

354 APTIC NUMBER 16925

Wyszynska, Halina
OCCURRENCE OF CORONENE, PERYLENE AND ANTHANTHRENE IN THE ATMOSPHERIC AIR DUST, BESIDES OTHER AROMATIC POLYCYCLIC HYDROCARBONS, NUMBERED AMONG CANCEROGENS. (Wystepowanie w pylach powietrza atmosferycznego koronenu, perylenu i antantrenu obok innych weglowodorow aromatycznych wielopierscieniowych zaliczanych do rakotworczych). Text in Polish. Roczniki Panstwowego Zakladu Higi., 19(3):261-269, 1968. 14 refs.

The content of coronene, perylene and anthanthrene in atmospheric dust was determined, as it is believed that these non-carcinogenic hydrocarbons can either hamper or enhance the carcinogenic activity of carcinogenic hydrocarbons, this action depending on the mutual ratio of both. The determination was carried out in 10 Polish towns between the 2nd half of 1965 through 1967. The benzene extract of the air dust was analyzed chromatographically and the individual fractions were identified according to their absorption spectra. The latter were also used for quantitative determination of the hydrocarbons. In all studied towns, the values for coronene were the highest and those for anthanthrene, the lowest. The average monthly content of all 3 hydrocarbons was higher in winter months and it increased with the increase in the benzo(a)pyrene, benzo(e)pyrene, and benzo(ghi)perylene content. The average monthly value of ratio benzo(a)pyrene/coronene was 1.6-10.6; the average annual value of this ratio was 2.3-4.8, and the highest values were found in Katowice, Zabrze, and Gdansk. This fact and also observations of higher values in winter months indicates that coal combustion is the main source of air pollution. The average annual ratio benzo(a)pyrene/perylene was 3.5-8. The presence of the weak carcinogens chrysene and benzo(a)anthracene was confirmed in all tests.

355 APTIC NUMBER 17268

Yanate, Noboru
STUDY ON THE DENSITY OF FORMALDEHYDE IN ATMOSPHERE. (Taiki chuh horumu arudehido nohdo ni tsuite). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 5(12):709-713, Dec. 25, 1969. 9 refs.

Atmospheric formaldehyde is generated by incomplete combustion of automobile fuel, oxidation decomposition of lubricating oil, and photochemical reactions of pollutants. The pollutant stimulates the mucous membrane and reduces the field of vision. For formaldehyde measurements, a colorimetric apparatus that uses acetylacetone as the absorber and color former was devised. Successive measurement have been performed with this apparatus since January 1968. The reagent is made by dissolving 150 grams ammonium acetate in water and adding 3 milliliters glacial acetic acid and 2 milliliters acetylacetone to the solution. After dilution with water to 2 liters, 0.2 grams sodium chloride is then added to prevent the influence of sulfur dioxide. The absorbtion rate is more than 95%. The stability of the solution is sufficiently high. On Iwaida Street, Kasumigasiki, Tokyo, as determined by the colorimetric apparatus, the traffic volume is about 40,000 cars a day. The minimum one hour formaldehyde value is 0.05 ppbm and the maximum, 4.8 ppbm. The minimum mean value in a day is 0.07 ppbm and the maximum, 1.96 ppbm. The minimum monthly mean value is 0.45 ppbm and the maximum, 0.90 ppbm. The yearly mean value is 0.76 ppbm. Since formaldehyde is considered to be generated also by photochemical reactions, seasonal differences in its density are presumed to exist. However, the data obtained do not clearly indicate seasonal variations.

356 APTIC NUMBER 14456

Yanate, M.
SUMMARY OF AIR POLLUTANTS LEVELS IN THREE STATIONS, TOKYO, 1966. (Tokyo-to nai San-chiten no Taikiosen-no Sokutei Kekka no Gaiyo, Jan.-Dec., 1966.) Text in Japanese. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo), 6(4):54-78, Oct. 1968.

In order to assess the influence of automobile exhaust gas upon air pollution, three stations have been established in Tokyo City for measurement of air pollutants. These stations are located in the business center (district A), a chemical industry (district B), and a highway intersection (district C). Hydrogen sulfide, nitrogen oxides, CO, suspended dust, total oxidized substances, amount of daily traffic, etc. were measured and recorded automatically. The results were studied with respect to monthly change during the year, hourly change during the day, daily change during the week, and concentration and distribution of pollutants. Correlation between the amount of pollutants and the amount of traffic has also been studied. Pollution due to exhausted gas seems to be increasing yearly. District A showed the highest concentration of H2S; the yearly average was 8.1 ppm. District C showed the lowest (4.3 ppm). Each district showed highest concentrations during the day. Carbon monoxide was lowest at 4:00 am in each district and reached its peak at 10:00 am, remaining high until 4-5:00 pm. A significant correlation was observed between CO concentration and the amount of traffic. District C showed more than 10 ppm during the day and even rose to 60 ppm momentarily. Nitrogen oxides were 2-4 times higher in district C as compared with the A and B districts. Suspended dust has been decreasing in all the districts, possibly due to the improvement of filtering systems and road conditions.

357 APTIC NUMBER 17278

Arai, Kenya
THE PROBLEMS IN ATMOSPHERIC DIFFUSION. (Taiki kakusan ni Ikeru shomondai). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 1(5):292-298, Dec. 15, 1965.

The recent trend in reducing air pollution caused by factory smoke is by atmospheric diffusion. Because a method of removing sulfur oxides has not yet been completed, the discharge of smoke into the atmosphere was tried. Atmospheric diffusion was studied in two ways. The coefficient of correlation between the source of contamination and concentration of the contaminants at ground level was analyzed in order to determine the condition of the exhaust gas which is safe for people. The meteorological condition which predominantly affects the coefficient of correlation was considered. A wind tunnel test and the calculation of diffusion belong to the first method, and a meteorological and topographical field survey belong to the second method. It was difficult to analyze and forecast atmospheric diffusion scientifically. Further study, however, will reveal the actual conditions of atmospheric diffusion, and make it possible to establish an adequate measure of air pollution. Several problems in pursuing these studies were also described.

358 APTIC NUMBER 16680

Berlyand, M. Ye., Ye L. Genikhovich, V. K. Dem'yanovich, and E. I. Onikul
INFLUENCE OF VERTICAL DISTRIBUTION OF TEMPERATURE AND SPEED ON WIND ON ATMOSPHERIC DIFFUSION OF RADIOACTIVE IMPURITIES. In: Radioaktivnyye izotopy v atmosfere i ikh ispol'zovaniye v meteorologii. Nauchnaya Konferentsiya po Yadernoy Meteorologii, Obninsk, 1964. Translated from Russian. Foreign Technology Div., Wright-Patterson AFB, Ohio, Translation Div. FTD-Mt-24-368-67, p. 10-19. 9 refs.
CFSTI, DDC: AD 682 226

Previous Soviet research on problems of atmospheric pollution from continuously active point sources was based on models of conditions for wind velocity and the coefficient of turbulent exchange prevailing in the surface boundary layer of the atmosphere. The present paper discusses the inapplicability of this model to many existing and planned point sources and to problems of radioactive fallout. It presents a quantitative analysis of the effects of lapse rates, wind velocity, turbulent exchange, and other factors of atmospheric diffusion. Included is a mathematical model which reflects these factors as they actually occur in the thick boundary layer.

359 APTIC NUMBER 16764

Breiland, John G.
VARIATIONS IN THE VERTICAL DISTRIBUTION OF ATMOSPHERIC OZONE DURING THE PASSAGE OF A SHORT WAVE IN THE WESTERLIES. J. Geophys. Res., 74(18):4501-4510, August 20, 1969. 3 refs.

Vertical distributions of ozone and of temperature taken from a series of balloon flights at Albuquerque, New Mexico approximately every 4 hrs over a 21-day period during which a short-wave upper trough passed over the station are studied together with synoptic meteorological data. The analysis indicates that with the approach of the trough and the simultaneous lowering of the tropopause and a southeasternward displacement of the subtropical jet stream over the station, there is an increase influx of O3-rich polar stratospheric air over the station in the form of thin layers, which replaces O3-poor subtropical air. This results in a layer structure characterized by several maxima and minima in the vertical distribution of the thermal stability as indicated by the temperature soundings. The layer structure is most pronounced between the lower tropopause and the 20-km level. The large-scale features of the layer structure, especially with regard to O3, show a remarkable persistence from sounding to sounding throughout the entire period of observations, which indicates that the layers associated with the long-wave pressure system and the accompanying jet stream have a very large horizontal, or quasi-horizontal, extent. At the same time, variations in the vertical distribution of O3 with respect to time, observed as the short-wave trough is being displaced with respect to the station, indicate that within the layer structure, especially in, or near, a trough, there also may exist horizontal gradients of the partial pressure of O3 of considerable magnitude in the direction of the flow as well as in a transverse direction. (Author's Abstract)

360 APTIC NUMBER 16683

Bullrich, Kurt
SCATTERING OF ELECTROMAGNETIC RADIATION BY PARTICULATE SUSPENSIONS IN THE ATMOSPHERE. In: Scatter Propagation of Radio Waves. Part I. Proc. AGARD Conf. no. 37, Paris, Advisory Group for Aerospace Research and Development, Paris (France), p. 13-1 to 14-4, 1968. 21 refs. (Presented at the 14th Symposium of the Electromagnetic Wave Propagation Committee of the Avionics Panel of AGARD, Sandefjord, Norway, Aug. 19-23, 1968.)
CFSTI, DDC: AD 685665

Electromagnetic radiation undergoes modification while passing through the atmosphere because of absorption and scattering processes. In the case of scattering, light radiation is deflected from its original direction of propagation so that the amount of its total energy can be reproduced by measurements at so-called scattering angles. In the case of absorption, absorbent gases in the atmosphere convert radiant energy into heat in specific wavelength ranges. Although the aerosol concentration of the atmosphere is less than the gaseous phase by several powers of ten, aerosol particles play an important part in scattering processes. Rayleigh's law does not adequately explain the distribution of radiance in the sky because it neglects scattering by aerosol particles in the molecular atmosphere and higher scattering in the turbid atmosphere. Evaluation of polarization phenomena and scattering of radiation in fog must consider aerosol particles, even though mathematical approximations for various types of aerosol particles and their scattering coefficients are not easily obtainable. The size distribution, structure, and refractive index of aerosols are surveyed.

361 APTIC NUMBER 16689

Byzova, N. L., G. B. Mashkova, and Yu. S. Osipov
RESULTS OF MODEL EXPERIMENTS ON THE PROPAGATION OF A SETTLING ADMIXTURE IN THE LOWER LAYER OF THE ATMOSPHERE UNDER VARIOUS METEOROLOGICAL CONDITIONS. In: Radioaktivnyye izotopy v atmosfere i ikh ispol'zovaniye v meteorologii. Nauchnaya Konferentsiya po Yadernoy Meteorologii, Obninsk, 1964. Translated from Russian. Foreign Technology Div., Wright-Patterson AFB, Ohio, Translation Div. FTD-MT-24-278-67, 10p., Jan. 12, 1968. 12 refs.
CFSTI: AD 679740

Particles dispersed from a chimney are carried by the wind and settle due to gravity. Present information is insufficient and does not permit the derivation of a formula for the practical calculation of chimney heights for new structures and the area of contamination. A 300 m meteorological tower was used to measure the dispersion of gases and smoke emanating from chimneys and carried by air currents. The aerosol source was located at various heights and sticky, plane tables were used in a radius of 10-20 km around the tower. A polymethyl-methacrylate powder consisting of particles 10-100 micron in size was used as the contaminant. The distribution of sedimentation density on the surface of the tables was measured, and a rough evaluation of volumetric concentration of the substance in the near-earth layer of the atmosphere was made. Tests were conducted under a variety of meteorological conditions, both in summer and winter and during the day and night. Temperature inversions were found to have significant effects on dispersal. Formulas, tables, and graphs for various conditions are presented. The parameters of the trace were found to depend on the heights of the source and the upper inversion boundary. Snow and rain were found to wash the admixture out of the atmosphere and deposit it closer than one would expect from the state of turbulent mixing.

362 APTIC NUMBER 16032

Clay, Don R.
DESCRIPTION OF COMPUTER PROGRAM SENS-A. Operations Research Inc., Silver Spring, Md., Contract DA 42-007-AMC-163(X), 31p., Nov. 8, 1965. 5 refs.
CFSTI, DDC: AD 684326

Computer program SENS-A is written in Fortran IV for an IBM 7044 computer. The program aids in the prediction of biological aerosol dissemination by aerial line release and the determination of the sensitivity of various meteorological and agent parameters in producing casualities. Either the Smith-Hay or Barad-Hilst cloud-diffusion models can be used in the program to predict the downwind dosage.

363 APTIC NUMBER 11765

Cramer, H. E., S. Barr, G. M. DeSanto, B. K. Dumbauld, B. R. Greene, F. A. Record, R. N. Swanson, and E. Y. J. Wong
SURVEY OF THE ELEVATED LINE SOURCE. GCA Corp., Bedford, Mass., Lab. of Applied Meteorology, Contract DA-42-007-AMC-120(N), RDT and E Proj. IV025001A128, GCA TR-66-13-G, 67p., March 1967. 28 refs.

Current procedures for predicting ground-level dosage patterns associated with elevated line sources are reviewed with respect to existing theoretical and empirical knowledge. Analysis of field measurements made during the Dallas Tower trials and the B 502 program at Dugway Proving Ground indicates that the elevated line-source technique is most effective when the releases are made at heights of about 100 meters above smooth terrain and under conditions of moderate or strong wind speeds and near-neutral thermal stratification. Requisite atmospheric dispersal and transport mechanisms depend on flow at ground level. This precludes the presence of moderate or strong temperature inversions located near ground level or at heights between the ground and release height. Both the Dallas Tower trials and the B 502 program confirm that little or no material reaches ground level within 40 or 50 km of aerial releases made above strong temperature inversions. It is unlikely that the penetration of such an inversion can be accomplished other than by very low release aided by aircraft wake turbulence. (Author summary modified)

364 APTIC NUMBER 16789

Eldridge, Ralph G.
MIST--THE TRANSITION FROM HAZE TO FOG. Bull. Am. Meteorol. Soc., 50(6):422-426, June 1969. 11 refs.

The transition from haze to fog is manifested by the occurrence of dissimilar optical phenomena which are a consequence of a change in the aerosol distribution of the scattering medium. Based on these effects, visibilities between 0.5 and 1 km are properly called mist. Visibilities in excess of 1 km are, generally, characteristic of haze; whereas, fog is limited to visibilities less than 0.5 km. (Author's Abstract)

365 APTIC NUMBER 15469

FISCAL YEAR 1967 SUMMARY REPORT OF METEOROLOGY PROGRAM SUPPORT TO THE NATIONAL CENTER FOR AIR POLLUTION CONTROL U. S. PUBLIC HEALTH SERVICE. Environmental Science Services Administration, Cincinnati, Ohio, Air Resources Lab. HLTH-ARL 4, 52p., Jan. 1968. 9 refs.

The present status of a variety of projects being conducted by the Air Resource Cincinnati Laboratory for the National Center for Air Pollution is briefly summarized. Analyses of tracer experiments in St. Louis indicates that both horizontal and vertical daytime dispersion over an urban area at distances to 10 miles from low-level sources is similar to that observed over open country and that vertical nightime dispersion over the urban area is much greater than that observed over an adjacent rural area. This supports the concept of the 'heat island' effect often producing a slightly unstable layer of air over the central city at night. A computer-soluble mathematical dispersion model was developed to calculate diurnal variation of emissions from space heating and to determine the values of plume centerline

trajectory and dispersion parameters at positions along the trajectory. Investigations of the urban 'heat island' in the Cincinnati area indicate that during nocturnal hours, when clear, light wind conditions persist, an unstable mixed layer of air prevails over the center city area, while a strong inversion usually exists at the surface in the adjacent rural areas. Analyses of radar-tracked constant volume balloons offers statistical evidence for the existence of longitudinal roll-vortices as major elements in mesoscale circulations in the planetary boundary layer. Sampling and chemical analysis techniques for three inert halogenated gases were perfected for a gaseous tracer system, to obtain dispersion data over relatively long travel distances. Analysis of turbidity network data suggests that atmospheric transmission of total solar radiation decreases as turbidity increases. Measurements of natural radioactivity in an urban-rural environment show that this technique is an inexpensive and helpful means of assessing mesoscale vertical mixing rates and dilution in the lower atmosphere. Meteorological support was provided to three abatement programs. These consisted of identification of pollutant sources in an Illinois city, calculation of sulfur dioxide transport between New York City and New Jersey, and determination of the extent and nature of visibility restrictions at a Midwest air terminal. The Illinois study revealed that a TVA steam plant was a significant source of SO2 and particulate emissions around the city. In the sulfur dioxide transport study, it was calculated that on a warm summer morning with westerly winds prevailing, 26.4 tons of SO2 per hr were crossing from New Jersey to New York.

366 APTIC NUMBER 16806

Garland, J. A.
CONDENSATION ON AMMONIUM SULPHATE PARTICLES AND ITS EFFECT ON VISIBILITY. Atmos. Environ., 3(3):347-354, May 1969. 16 refs.

Ammonium sulfate is a frequent and important constituent of the atmospheric aerosol in some areas. Calculations have been carried out to determine, as a function of relative humidity, the size of $(NH_4)_2SO_4$ nuclei, and the extinction coefficient (which determines the visibility) of monodisperse $(NH_4)_2SO_4$ aerosols. The method for extending the calculations to heterodisperse aerosols is outlined and the results for a Junge type haze distribution and an experimental $(NH_4)_2SO_4$ nuclei has also been found. (Author's Abstract)

367 APTIC NUMBER 15655

Menzavalt, Ronald B.
SOIL PROPERTIES AFFECTING THE SORPTION OF ATMOSPHERIC AMMONIA. Soil Sci. Soc. Am. Proc., 33(5):725-729, Sept., Oct. 1969. 19 refs. (Presented at the Western Society of Soil Science, Los Angeles, June 1967.)

The influence of several soil factors on the rate of sorption of atmospheric ammonia was evaluated. The contribution of both atmospheric and soil factors in governing the overall sorption process was placed in the proper perspective. At controlled atmospheric-level ammonia concentrations, ammonia sorption from the atmosphere was weakly correlated with increasing cation exchange capacity and percent clay. Alteration of organic matter content and soil acidity produced only slight changes in sorption rates. These data indicate that lack of bonding sites per se does not limit the sorption rate. In air dry soil, the major portion of the sorption occurs in the uppermost 0.5 cm. Sorption rates were closely related to increasing air permeability and moisture content. Since atmospheric ammonia concentration, air velocity across the soil surface, and temperature also strongly influence sorption rates, it is concluded that sorption of atmospheric ammonia by soils is primarily governed by those factors which effect the rate of supply of ammonia to the soil surface and the fraction of the ammonia molecules which are actually captured. (Author abstract modified)

368 APTIC NUMBER 16772

Hinds, W. T.
PEAK-TO-MEAN CONCENTRATION RATIOS FROM GROUND-LEVEL SOURCES IN BUILDING WAKES. Atmos. Environ., 3(2):145-156, March 1969. 20 refs.

A short series of tests was conducted to determine whether ground level point sources at the upwind stagnation point of a large building yielded peak-to-mean concentration ratios that were significantly different than those observed for ground level point sources in unobstructed flow. Time-average concentrations over test periods of 6-15 min were measured to delineate the spatial extent of the plume for both types of flow conditions. Also, 5-sec averages of concentration at a point near the centerline of the plume were measured to indicate the time history of concentration. The results indicated that there was no detectable difference between peak-to-mean ratios measured in unobstructed flow and in the lee of a building with a point source near the upwind stagnation point. Because of the strong dependence of wake diffusion on source location, no conclusions were possible concerning peak-to-mean ratios from sources located at sites other than the upwind stagnation point. (Author's Abstract)

369 APTIC NUMBER 17305

Jauregui O., Ernesto
METEOROLOGICAL ASPECTS OF THE AIR POLLUTION PROBLEM IN MEXICO CITY. (Aspectos meteorologicos de la contaminacion del aire en la ciudad de Mexico). Text in Spanish. Ing. Hidraul. Mex. 23(1):17-28, 1969. 9 refs. (Presented at the 2nd Convencion Conjunta del Inst. Mex. de Ing. Quimicos y la Am. Inst. Chem. Eng., Sept. 26.)

Pollution problems in Mexico City are intensified by a combination of meteorological and topographical problems. The city is hemmed in by mountains which block the circulation of air; during the dry season, there are massive temperature inversions, most frequent in January and May. Between January and May, 10 to 20 cases of prolonged inversion occur each month; from June to October, only 5 to 8 occur. Records have been kept of visibility from 2 points in the Mexico City area: the Tacubaya observatory and the International Airport. A study of these in comparison with recorded wind directions in 1937-1966 indicate a serious

aggravation of air pollution. Artificial pollution is aggravated by natural pollution (dust storms) during the dry season. Visibility at noon in the year 1937 was not equalled until 2 PM or even 4 PM in 1965-1966, indicating that 2-4 additional hours are now needed for atmospheric pollution to clear up. Whereas earlier the visibility sharply declined after 4 PM, more recent observations show that now the visibility 2 hours later is at least as high if not higher. In the 8-year period 1952-1960, visibility underwent a dramatic reduction from 10-14 miles to 9-10 miles at 10 AM. In the same period, visibility after 4 PM increased from 10 miles to 14-15 miles. The same period also saw a significant increase in the frequency of low visibility (less than 3 miles), amounting to more than 20% during the second half of the dry season.

370 APTIC NUMBER 17062

Rao, S. K. and William R. Hill
CHARACTERISTICS OF THE LARGE-SCALE DISPERSION OF PARTICLES IN THE SOUTHERN HEMISPHERE. J. Atmospheric Sci., 29(1):126-132, Jan. 1970. 12 refs.

Lagrangian and Eulerian wind data at the 200 mb level in the Southern Hemisphere were analyzed to determine the differences and similarities in the dispersion of particles by large-scale atmospheric motion in the two hemispheres. The zonal component of the eddy diffusivity in mid-atmosphere in the Southern Hemisphere was found to be 50% greater than in the Northern Hemisphere, but the meridional component of the eddy diffusivity was about 50% smaller. The coefficient of the Eulerian-Lagrangian time-scale transformation in the Southern Hemisphere is about 0.6, of the same order of magnitude as then in the Northern. The autocorrelation functions and energy spectra of the Eulerian and Lagrangian velocities are similar in both hemispheres; in the Southern Hemisphere, the peak of the energy spectrum of the meridional component of the Lagrangian velocity occurs near the frequency 0.018 cycle reciprocal hr, about the same as in the Northern. (Author abstract modified)

371 APTIC NUMBER 17142

Littman, F. E., N. W. Ford, and N. Endow
FORMATION OF OZONE IN THE LOS ANGELES ATMOSPHERE. Ind. Eng. Chem., 48(9):1492-1947, Sept. 1956. 6 refs.

A discovery that oxidant could be formed experimentally by the irradiation of night air led to an investigation of the physical and chemical properties of the impurities (oxidant precursors) which form oxidant. That light was responsible for the formation was demonstrated by using two oxidant recorders, one indicating the oxygen concentration in untreated air and the other, the concentration in irradiated air. As determined by optical cut-off filters, the primary light acceptors absorbed from the short wave end of the visible spectrum to below 3600 Å. Spectrometric analyses of precursors caught in liquid-oxygen cooled dry ice traps showed that the bulk of the precursors comprised carbon dioxide and water, with the balance made up of organics. Nitrogen oxides were detected with a Griess reagent. The amount of nitrogen dioxide found suggested that some of it had formed during the collection and/or irradiation of the air sample. Further experiments established that nitric oxide is present in the air in quantities well in excess of those of nitrogen dioxide and that nitric oxide rapidly oxidizes to nitrogen dioxide in the presence of hydrocarbons: oxidation is accompanied by the formation of ozone. The quantitative aspects of ozone formation by the photolysis of nitrogen dioxide are now under investigation.

372 APTIC NUMBER 16795

Marsh, K. J. and V. R. Withers
AN EXPERIMENTAL STUDY OF THE DISPERSION OF THE EMISSIONS FROM CHIMNEYS IN READING--III: THE INVESTIGATION OF DISPERSION CALCULATIONS. Atmos. Environ., 3(3):281-302, May 1969. 11 refs.

Six-hour concentrations of SO2 were measured at 40 sites in Reading during a 15-month period, together with the relevant meteorological data. An inventory of the sources of SO2 was compiled and the data have been used to test dispersion models for calculating pollution. These models were based upon the dispersion equation for a single chimney. The criterion used for testing the models was the root mean square error (R.M.S.E.) of the differences between pairs of observed and calculated concentrations. The investigation finally concentrated on examining empirical models containing only the meteorological parameters which correlated with the observed concentrations. In the first series of tests, using pollution data from 6 sites, it was shown that there was no improvement in the estimates of pollution when hourly meteorological data were used instead of 6-hr average data. A second model was tested in which housing areas were treated as crosswind line sources and individual sources were treated as single chimneys. This was compared with the previous model, which treated both areas and individual sources as single chimneys. The test was made using only measuring periods in which the wind direction was reasonably steady in order to sharpen the comparison, but there was nothing to choose between the models. A repeat test using period of less steady wind directions confirmed that, although the errors were greater, they did not differ between the models. The application of these models to all 40 sites using the selected meteorological data showed that the root mean square error of the estimates was roughly equal to the mean of the observed concentrations. Regression equations were calculated from the same data, comparing concentration measurements with a parameter derived from air temperature and wind speed. The root mean square errors from these were consistently lower than those from the dispersion models. This suggested formulating empirical equations based upon a similar parameter derived from air temperature and wind speed, but also including various functions of the distribution of sources around each measuring site. These were tested with the same data used for the dispersion models and were found to give better estimates of the observed concentrations. It is concluded that the dispersion equations do not provide a satisfactory basis for calculating the pollution from extended sources such as housing areas. The better precision given by the empirical equations suggest that a model for extended areas in a town should be developed on the same lines, while retaining the dispersion equation for the tall chimneys. In densely populated countries, such as England, any pollution models will have to take account of pollution arriving from other towns. (Author's Abstract)

373 APTIC NUMBER 17298

Ministry of Health and Welfare, Tokyo (Japan) and Ministry of International Trade and Industry (Japan)
ABSTRACT OF ATMOSPHERIC DIFFUSION SURVEY PROJECT AT NEGISHI AREA IN YOKOHAMA CITY. (Yokohama-shi negishi chiku taiki kakusan chosa jisshi yoryo). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 3(8):483-486, Aug. 15, 1967.

A field survey is underway to determine the status of air pollution in the Negishi industrial district of Yokohama and to obtain data for implementing an air pollution control program. In the survey, diffusion is being tested by the use of fluorescent particles and observations of its radius at 6 deg intervals and at 105 crossing points. Meteorological observations gathered at the site of the dispersion test include vertical variations and distribution of wind speed and direction and temperature measurements, in addition to general ground layer atmospheric phenomena. Atmospheric stability and its vertical and horizontal variations are to be investigated from pirot balloon and helicopters. The temperature and amount of exhaust gas emitted from a chimney of effective height will be measured with a thedolite. A smoke candle will be inserted in the chimney and its behavior under various weather conditions photographed from a helicopter. The survey is administered by a head office responsible for supervising all activities performed by specialists. Staff members are responsible for technical aspects of the survey. Meteorological observers are in charge of daily measurements of onland wind speed and direction. Those handling the pirot balloon and measurements are divided into two groups: one group is concerned with the selection of colored smoke candles according to weather conditions at test time; the other will measure tentative exhaust gas from a chimney at a downwind distance.

374 APTIC NUMBER 16846

Mosher, J. C., W. G. MacBeth, M. J. Leonard, T. P. Mullins, and M. F. Brunelle
THE DISTRIBUTION OF CONTAMINANTS IN THE LOS ANGELES BASIN RESULTING FROM ATMOSPHERIC REACTIONS AND TRANSPORT. J. Air Pollution Control Assoc., 20(1):35-42, Jan. 1970. 11 refs.

Different techniques of data analysis have been successfully applied to Los Angeles County air monitoring data to delineate major source areas for carbon monoxide, sulfur dioxide, nitrogen oxides, and ozone; to develop contaminant transport patterns; and to demonstrate the progress of photochemical reactions in the Los Angeles atmosphere. The heavily industrialized South Coastal, Southwest Coastal, and East San Fernando Valley areas are most affected by contaminants derived from fuel combustion at stationary sources. Emissions from mobile sources are heavily concentrated in some of the above source areas and also in the Central area. Seasonal variations in weather affect the total contaminant emissions as well as the distribution, transport, and ultimate fate of the individual contaminants. More frequent surface inversions in winter, combined with greater quantities of emitted contaminants, result in winter time atmospheric concentrations of primary contaminants (carbon monoxide, nitric oxide, sulfur dioxide, and particulates) more than twice as high as comparable summer time concentrations. Stronger on-shore breezes of longer duration transport contaminated air parcels farther across the County during summer. Longer, more effective irradiation and low persistent inversions result in higher ozone concentrations in summer. Air monitoring data confirm the photochemical formation of ozone during transport of air parcels along the most common "pathways" of transport--the prevailing wind flows from coast to inland areas. (Author's Abstract)

375 APTIC NUMBER 16687

Onikul, B. I., G. A. Panfilov, B. V. Rikhter, and B. S. Gil'denskiol'd
RESULTS OF ANALYSIS OF EXPERIMENTAL DATA CHARACTERIZING THE DISTRIBUTION OF ATMOSPHERIC POLLUTIONS NEAR THE THERMAL ELECTRIC POWER STATIONS. (Rezul'taty analiza eksperimental'nykh dannykh, kharakterizuyushchikh raspredeleniye atmosfernykh zagryazneniy vblizi teplovykh elektrostantsiy). Tr. Gl. Geofiz. Observ. (Moscow), no. 172:23-34, 1965. 13 refs. Translated from Russian. Foreign Technology Div., Wright-Patterson AFB, Ohio, Translation Div. FTD-MT-24-186-67

Meteorological and aerological data were collected on the diffusion of sulfurous gas and ashes from stacks of thermal electric power stations from 1961 to 1963. A method for analyzing the experimental data on surface concentrations at various distances from the plants was described in detail and contrasted with conventional methods of finding average sulfur dioxide concentrations. The method permits the determination of maximum SO2 concentrations and calculations of dangerous wind speeds. The results obtained by the method were in good agreement with theoretical calculations. Maximum SO2 concentrations at all sampling points were related to the wind speed, which depended on the initial flue gas exit speed from stacks and the degree of their overheating. At low speeds, flue gases rise to a great height. At higher speeds, the effective height is small, but the gases are dispersed over a greater distance. Rapid increases in surface concentrations follow initial increases in wind speed, but only very small changes in surface concentrations occur thereafter.

376 APTIC NUMBER 17185

Oota, Yoshio
SMOG AND GROUND LAYER METEOROLOGY (I) - TO INVESTIGATE ON THE RELATION BETWEEN WEATHER PHENOMENA AND THE STATE OF AIR POLLUTION MAINLY IN TOKYO. (Sumoggu to kukan gensho (I) - Omoni Tokyo niokeru kisho gensho to osentaiyo no kankei o saguru). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(4):232-238, April 15, 1966.

Weather phenomena leading to the occurrence of smog in a polluted area are investigated by three types of approaches. The first deals with separate factors associated with weather phenomena in a given survey field. The second approach is concerned with an overall investigation of the behavior of atmospheric pressure as viewed from composite meteorological conditions. The third approach is a so-called vertical observation; it contrasts with the first and second approaches which can be defined as horizontal observations of weather

phenomena. The first approach includes the analytic investigation of data which may show the interaction of air pollution with general weather condition, temperature inversion, wind velocity, and wind direction. A continuous curve graph of wind direction is used to exclude deflection errors due to the influence of atmospheric pressure movements. Dispersion formula are also included in the approach. In the second approach, a continuous curve graph of general weather phenomena which gives a clue to horizontal atmospheric movement is obtained. The relationship between fluctuations in atmospheric pressure and the continuous curve determines the precision of the graph. The general curve graph presents an evenly-curved line but is turned to show discontinuance of the line in the presence of interferences such as land and sea winds, frontogenesis, endemic atmospheric discontinuity, plus a line of geographical discontinuity. Results of the first two analytic procedures show that density of air pollution is closely related to atmospheric stability at many points and the rise and fall of temperature.

377 APTIC NUMBER 17197

Oota, Yoshio
SMOG AND GROUND LAYER METEOROLOGY (II). TO INVESTIGATE ON THE RELATION BETWEEN THE VERTICAL VARIATION OF TEMPERATURE AND THE CONCENTRATION OF AIR POLLUTION. (Sumoggu to kukan gensho (II) - Kion no suichoku henka to ozennodo tono kankei o saguru). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(5):306-312, May 15, 1966. 22 refs.

This study is part of a series on smog and ground layer meteorology. It discusses vertical daily variations in air pollution; the relationship between vertical temperature stability, and air pollution density during ground-layer atmospheric inversions; and variations in air-pollution density at the time of atmospheric layer transformation caused by a line of discontinuity. Vertical changes in temperature affect the hydrostatic stability of weather phenomena, and this alters the dispersion of pollutants and the lapse rate of pollution density. Extreme dispersion of atmospheric pollutants is observed at night, when vertical temperature inversions occur and when atmospheric turbulence at a relatively low ground layer causes enforced wind speed in the upper layer (about 10 m/s). Vertical rises in temperature coinciding with sunrise result in the gradual disappearance of temperature inversions, beginning in the lowest layer and progressing through to the stable layer. At this time, depending on the degree of heating, horizontal and vertical eddies can mix the lower layer with the upper layer. This heat convection which occurs first in the lowest layer, explains why the difference between wind speed in upper and lower layers decreases and why, after sunset, vertical temperature fall begins at ground layer and atmospheric inversion occurs again. Wind speed gradually declines at the same time, i.e., atmospheric pollutants do not decend from but rise to the upper layer.

378 APTIC NUMBER 17194

Panofsky, Hans A.
AIR POLLUTION METEOROLOGY. Minerals Process., 10(9):11-16, 60-61, Sept. 1969. 3 refs. (Also: Am. Scientist, Summer 1969.)

Atmospheric conditions affecting the distribution and behavior of pollutants are discussed with reference to their relation to the height of pollution sources and their effects on pollutant transport and dispersion. In the case of effluent rise, the most important meteorological factors are wind speed and temperature lapse rate. Although not yet in general use, dimensional-analysis formulas offer the most promise for plume rise measurements. Given the height of effluent rise above a stack, an 'effective' source is assumed for calculating transport and dispersion. Pollutants travel with the wind, but only the large-scale features of wind patterns are known. One of the important problems for the air pollution meteorologist is to infer the local wind pattern on the mesoscale from ordinary airport observations. Dispersion of a contaminant depends on the mean wind speed and the characteristics of atmospheric turbulence. Dispersion of a plume from a continuous elevated source in all directions increases with increasing roughness and with increasing convections relative to mechanical turbulence. Equations are presented for estimating pollutant concentrations and diurnal and day-to-day variations in air pollution.

379 APTIC NUMBER 12433

Perkins, W. A. and R. W. McMullen
THE CHANGE IN PARTICLE SIZE DISTRIBUTION OF FLUORESCENT PARTICLE TRACER DURING CITY WIDE TRAVEL. Metronics Associates, Inc., Palo Alto, Calif., Aerosol Lab., Contract CWB 10313, TR-95, 15p., Aug. 15, 1962. 1 ref.

The particle size distribution of fluorescent particles on collected samples at several distances from the source and changes in size distribution with distance were determined. A total of 18 samples from 4 field experiments were examined and particle size distributions prepared. Two or 3 downwind distances were selected in each trial, ranging from 2.5 to 18 miles from the source. Three methods of data treatment were used which included two tests to establish the statistical significance of differences in the size distributions and one test to estimate particle loss during transport. The tracer material used had an unusually high proportion of small particles. At least 66.8% were less than 2 micron in diameter; in most samples, over 70% were less than this size. Taken in pairs and using all combinations of samples taken at different distances, 20 pairs showed no significant difference in size distribution and 8 showed significance under the more severe treatment test. Of the 4 trials examined, one showed an apparent loss of particles; one an apparent gain; and 2 showed no change. From the results, it was concluded that the 4 trials did not demonstrate a consistent, statistically significant loss of particles. In the case where losses were indicated, they did not exceed 26% in 16 miles. There was some question as to whether the indicated loss was real. (Author summary modified)

380 APTIC NUMBER 17034

Pressman, Jerome and Peter Warneck

THE STRATOSPHERE AS A CHEMICAL SINK FOR CARBON MONOXIDE. J. Atmospheric Sci., 27(1):155-163, Jan. 1970. 45 refs.

Stratospheric carbon monoxide removal is discussed and the significance of the stratosphere as a sink for CO is demonstrated. On the basis of two theoretical models, an attempt is made to determine whether the size of the sink is compatible with present knowledge of anthropogenic CO sources and available measurements of atmospheric CO concentrations over the past 20 years. The stratosphere provides a sink for CO due to the reaction OH + CO yields CO2 plus H. The radical OH is produced photochemically in a moist ozonosphere with a time constant several orders of magnitude less than that of the CO oxidation reaction. As a result, almost all the CO entering the stratosphere is destroyed. The rate limiting factor is the transport of CO-rich air through the tropopause. Although the theoretical models provide several constraints for the rate of CO removal from the atmosphere, it is found that the uncertainties concerning measurements and source functions preclude the derivation of a reliable value for the total CO removal rate. An estimate indicates that the stratospheric sink contributes significantly, but only partially, to overall removal of CO from the atmosphere. (Author abstract modified)

381 APTIC NUMBER 15713

Raff, R. A. and G. M. Meaburn
PHOTOCHEMICAL REACTION MECHANISMS FOR PRODUCTION OF ORGANIC COMPOUNDS IN A PRIMITIVE EARTH ATMOSPHERE. Nature, 221(5179): 459-460, Feb. 1, 1969. 19 refs.

Thermodynamic considerations dictate the existence of a reducing atmosphere on the earth during the synthesis of prebiological organic compounds. Some of the reactions by which a primitive atmosphere might have given rise to reduced compounds of C and N are explored. The assumptions on which the discussion is based are: (1) The total amount of hydrogen on the earth was larger than it is now and was present primarily as water; (2) the gases of the atmosphere were produced in the crust of the earth at high temperatures by the reaction of water with metals, carbides, nitrides, etc.; (3) the outgassing occurred over a considerable span of geological time. The outgassed atmosphere was subjected to a variety of reactions induced by solar radiation and electrical discharges.

382 APTIC NUMBER 17035

Roedel, Walter
ON THE BEHAVIOR OF SHORT-LIVED COSMIC RAY PRODUCED NUCLIDES IN THE LOWER ATMOSPHERE. Z. Naturforsch., 24a(12):1897-1903, Dec. 1969. 25 refs.

Some aspects of short-lived cosmic ray-produced (CRP-) nuclides in the lower atmosphere, especially Na24, and their qualities as tracers for atmospheric motion were studied. Estimates are given of the Na24 production rate; the distribution of the nuclide as a function of altitude in the lower atmosphere is described by a steady-state eddy diffusion model. Measurements of the specific Na24 activity at ground level varied from 0.00007 to 0.00028 dpm/cu m. These figures are in good agreement with calculated values for reasonable diffusion parameters. Calculations suggest that CRP-nuclides with lifetimes in the order of a day are useful as tracers for atmospheric motions in the range of eddy diffusion coefficients of about 50,000 to several 1,000,000 sq cm reciprocal sec, and for altitudes below 4 or 5 km. Relations between the specific radioactivity of rainwater and the specific activity of cloud-level air, with special respect to short-lived CRP-nuclides, are demonstrated. Measurements of Na24 activity in rain water show good consistency between real atmospheric conditions and calculated values. (Author abstract modified)

383 APTIC NUMBER 17110

Rozenberg, G. V.
OPTICAL STUDY OF ATMOSPHERIC AEROSOL. (Opticheskiye issledovaniya atmosfernogo aerozolya). Text in Russian. Usp. Fiz. Nauk, 95(1):159-208, 1968. 235 refs.

The following topics are treated in this review article: aerosol composition and particle size distribution; equilibrium-solution state; precondensation state; theoretical aspects of aerosol optical properties; optical methods for studying the atmosphere as one aspect of the general problem of indirect measurement; optical properties of aerosols and the microphysics of the dispersed phase; and aerosol structure of the atmosphere and vertical variation of dispersion coefficient.

384 APTIC NUMBER 16769

Schmidt, F. H. and C. A. Velds
ON THE RELATION BETWEEN CHANGING METEOROLOGICAL CIRCUMSTANCES AND THE DECREASE OF THE SULPHUR DIOXIDE CONCENTRATION AROUND ROTTERDAM. Atmos. Environ., 3(4):455-460, July 1969. 5 refs.

Due to the ever growing anxiety about the effects of air pollution on the health of the inhabitants of industrialized regions, every decrease of the average concentration of a pollutant such as SO2 is welcomed, by the authorities as well as by the public. In various cases such a decrease may be attributed to improved methods to reduce the escape of noxious gases but sometimes meteorological circumstances paly an important role. During the last six winters there was an almost continuous decrease of the SO2 content of the air in the region of Rotterdam. Although an improvement of some industrial processes may have helped to bring about this decrease, it can be shown that meteorological circumstances contributed significantly. (Author's Abstract)

385 APTIC NUMBER 16918

Scorer, R. S.
THE BEHAVIOR OF CHIMNEY PLUMES. Intern. J. Air Pollution, vol. 1:198-220, 1958-1960. 10 refs.

Formulas available for computing the pollution from an isolated chimney are too complicated for practical use. The weather conditions in which they are correct are not usually the most

important that can occur. Therefore, simpler formulas are proposed that can be used if the complexities of the actual weather are understood. The rise due to efflux momentum and buoyancy is calculated using simple formulas derived by dimensional analysis and simple experimental constants. The plume is assumed to be bent over when the upward velocity is about equal to wind speed and the rise assumed to be complete when the upward velocity is reduced to a certain fraction of the wind speed. When the rise is complete, the effluent is carried passively by the ambient turbulence. The formulas acknowledge three different regimes in which efflux momentum, buoyancy, and ambient turbulence successively dominate the mixing process. When a plume contains liquid water, an appreciable amount of heat can be lost when it evaporates on mixing with the environment. A diagram is given for computing the effect on buoyancy. It may be enough to make the plume sink rapidly to the ground. It is argued that architects should accept the chimney heights necessary for the proper dispersal of pollutants as a requirement and consider the chimney as an integral part of a building instead of an undesirable appendage. (Author abstract modified)

386 APTIC NUMBER 16985

Scorer, R. S.
WET AND COLOURED PLUMES AND NATURAL POLLUTION. In: Air Pollution. London, Pergamon Press, 1968, Chapt. 5, p. 86-106.

The thermal, mechanical, and optical effects that influence visible air pollution are explained. The behavior of wet-scrubbed effluent gas from power station is variable because it depends on the amount of water evaporated in the washing chamber and the extent of the subsequent cooling before emission; these, in turn, depend on the temperature ranges of the water and gases in the washing, and are determined by their flow rates and mechanisms of contact. Distinction is made between droplets from splashing in a cooling tower or scrubbing chamber and droplets formed by condensation due to cooling like smoke and pollution gases, the latter travel with the air. Condensation of water cloud after emission is a good feature of a plume from the standpoint of pollution on the ground; condensation before emission by cooling in a stack or washing chamber is very undesirable. The basis for these principles is explained and numerous photographs provide illustrations of varieties of plume appearance and behavior. The whiteness of a sulfur trioxide-laden plume is determined as much by the size of the particles as by the amount of SO3 present; SO3 plumes are blue when the particles are very small, become white at some larger size, and then become invisible when the same amount of SO3 is condensed into still fewer large particles. Colored plumes may take their color from the particles of smoke that make them visible; micron-size particles of red iron oxides create the red smoke often seen at steelworks. Sulfuric acid mist may produce a blue color when the particles are very small, and the reddish brownish color of some power station plumes is the natural color of the small fly ash particles which pass through the electrostatic precipitators. Some forms of visible natural air pollution are discussed, including salt haze from the sea, dust hazes, and blizzards.

387 APTIC NUMBER 15633

Servant, Jean and Chi Trach Hoang
VERTICAL EXCHANGES OF ARTIFICIAL AEROSOLS IN THE TROPOSPHERE. (Les echanges verticaux des aerosols artificiels dans la troposphere). Text in French. C R Acad. Sci., Paris, Ser. B, 268(25):1686-1688, June 23, 1969. 6 refs.

The Sr90 radioactivity of rain water is on the average, equal to that of the air of the pluviogenic zone of the atmosphere. Hence, by comparing this value with that of air near the ground, one obtains the variations of the intensity of exchange of matter and air between the ground and the pluviogenic zone at different times of the year. This comparison also enables one to determine the mode of transport of solid aerosols in the atmosphere by noting the signature of the concentration gradient as a function of altitude. With this objective in view, data from the American network of stations were used for analysis of artificial radioactive aerosols for the years 1963 to 1965 to determine the monthly mean ratio of the Sr90 concentration in air near the ground and in rain water in latitude bands of 10 deg between the latitudes 80 deg north and 60 deg south. The data show that the vertical exchanges between the ground level and the pluviogenic zone of the atmosphere are appreciable at the mean latitudes. This is also true of the polar region (Greenland) in spring and fall and of the equatorial region (Panama Canal) in summer and fall. However, in these regions, the vertical exchanges are weaker than at the mean latitudes during the rest of the year.

388 APTIC NUMBER 16838

Shaw, P. J. R.
WHAT MEASUREMENTS ARE REQUIRED FOR AIR POLLUTION METEOROLOGY. Clean Air (J. Clean Air Soc. Australia New Zealand), 3(2):3-9, June 1969. 32 refs.

The theoretical and empirical formulae for dispersion of airborne pollutants from point and area sources, and for the plume rise from a stack, still give uncertain predictions of ground level concentration, in spite of many investigations reported in a considerable volume of literature over the last ten years. In favorable circumstances at the site adequate qualitative estimates may be made from existing meteorological data. For large stacks a meteorological survey at the site is required to answer the engineer's question, so about a year's notice should be given. Prediction of the dispersion of pollutants from an area source, such as a city, requires knowledge of wind and temperature distribution in the horizontal and vertical, which is not available at most places in Australia. The required observations could become available if the demand were great enough. (Author's Abstract)

389 APTIC NUMBER 17295

Suzuki, Shin
CHEMICAL REACTION OF AIR POLLUTANTS, ESPECIALLY THE SECONDARY REACTIONS DUE TO PHOTOCHEMICAL REACTION. (Taiki osen no kagaku hanno, tokuni kokagaku hanno nitomonau kozokuhanno). Text in Japanese. Kagaku No Ryoiki (J. Japan Chem.), 23(9):840-850,

Sept. 1969. 16 refs.

Air pollutants change into new complexes by photochemical reaction. The most famous example of photochemical smog is in Los Angeles. The early reaction stages were previously described. The importance of secondary reactions is usually determined by their generation velocity. Air pollutants of generation velocity below 1 ppm per hour have little importance, and those below 0.1 ppm are negelected. The secondary reactions are classified according to their central substances, reactions of oxygen atoms, ozone, nitrogen oxides, organic radicals, and hydrocarbons. The generation mechanisms of Los Angeles smog and London smog were studied. The predominant reactions of Los Angeles smog are considered to be photochemical reactions with nitrogen dioxide, oxygen, and hydrocarbons. London smog is produced by the photochemical or catalytic reaction with sulfur dioxide and oxygen. The distinctive features of Los Angeles smog are generation of oxidants and organic fog, eye irritation, plants damage, and carbonization of gum. The above phenomena are characteristic of ozone, aldehydes, ketones, peroxides, nitrates, and nitrites. London smog is explained by generation of sulfuric acid.

390 APTIC NUMBER 16415

Yordanov, Dimit'r
TURBULENT DIFFUSION IN THE NEAR-GROUND AIR LAYER. II. (V'rkhu turbulentnata difuziya v prizemniya v'zdushen sloy. II). Text in Bulgarian. Izv. Geofiz. Inst. Bulgar. Akad. Nauk., vol. 9:5-22, Dec. 30, 1966. 12 refs.

This mathematical treatment deals with vertical diffusion in the near-ground air layer as a two-layer problem. Numerical calculations are tabulated and plotted. Asymptotic representations of solutions for brief and prolonged diffusion are given, and it is demonstrated that these presentations have definite physical significance. The area of applicability of the asymptotic representations is evaluated. It is also demonstrated that the results given may be extended to the important case of diffusion from a point source in the near-ground air layer.

391 APTIC NUMBER 17261

Adachi, Takayoshi
ON THE BEHAVIOR OF PARTICLES IN THE ELECTROSTATIC PRECIPITATOR. (Denkishujinki naino ryushi no kyodoh nitsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(6):405-411, July 15, 1966. 6 refs.

A theoretical study was made on the behavior of charged particles in the field of corona discharge. The theory was developed on the assumption that the sum of the Coulomb force in the electrostatic field and the image force with respect to a grounded electrode are equal to the damping force of gravity acting on the particle due to the tension of a string, which suspends the particle. The agreement between the theoretical and observed values was excellent. A considerable amount of ion wind was observed, but its effect on the measured results was negligible. When the electroconductive particles were attracted close to the precipitator electrode, they oscillated with a small amplitude, keeping a small discharge gap with the electrode. An equilibrium of the electrical charge was maintained without the adhesion of the particles to the electrode. No change was observed in the spark gap, even when the corona discharge voltage was fluctuated. The insulator particles jumped around when the corona voltage was low. The particles, however, completely adhered to the electrode when the voltage was elevated. When the discharge capacity of the contract surface was small, a glow discharge discharge was maintained along the surface. A theoretical analysis is being made on the behavior of the electroconductive particles.

392 APTIC NUMBER 17303

Annis, B. K., A. P. Malinauskas, and K. S. Yun
COMPOSITION DEPENDENCE OF THE THERMAL-DIFFUSION FACTOR OF A DUSTY GAS. J. Chem. Phys., 52(4):1992-1996, Feb. 15, 1970. 26 refs.

The composition dependence of the thermal diffusion factor alpha T of a dust-laden gas mixture is derived. In the case of a monoatomic gas, (alpha T) reciprocal is shown to vary linearly with the mole fraction. In the case of a polyatomic gas, nonlinear contributions arise as the result of inelastic gas-gas collisions. Application of the results to a description of thermal transpiration in terms of a 'dusty-gas' model yields a correction to the previously derived equation for thermal transpiration and may have a significant effect on the determination of rotational collision numbers for thermal transpiration measurements. (Author abstract modified)

393 APTIC NUMBER 16037

Balakirev, A. A. and V. K. Tikhomirov
INTERACTION OF DUST PARTICLES WITH FOAM BUBBLES AND SOLUTIONS. Colloid J. (USSR) (English translation from Russian of: Kolloidn. Zh.), 30(1):4-6, Jan.-Feb. 1968. 2 refs.

Interaction of spherical glass particles with foams, surfactant solutions, and organic liquids was studied by measurement of the forces required to detach the spheres from their surfaces. The forces required to detach the particles from foam bubbles are always greater than for the surfaces of the corresponding surfactant solutions. The difference between the forces required to detach particles from foams and solutions is proportional to the cross-sectional area of the particle. The stronger adhesion of particles to foam bubbles than to solutions is due to capillary effects in the foam films. An empirical equation is derived to calculate the force required to detach glass particles with diameters of 15-350 micron from the surface of surfactant solutions. (Author summary modified)

394 APTIC NUMBER 12211

Bauneister, Kenneth J. and Thomas D. Hamill
LIQUID DROPS: NUMERICAL AND ASYMPTOTIC SOLUTIONS OF THEIR SHAPES. National Aeronautics and Space Administration, Cleveland, Ohio, Lewes Research Center, NASA TN D-4779, 18p., Sept. 1968.

The boiling and condensing heat-transfer characteristics of wetting and nonwetting liquids often depend on the geometrical characteristics of liquid drops in contact with solid surfaces An analysis is developed in which the equilibrium shapes of liquid drops supported by a flat horizontal surface were determined by a Runge-Kutta solution of the Laplace capillary equation. A characteristic length equal to the square root of surface tension divided by the product of density and gravity was used to nondimensionalize the numerical results. In addition, asymptotic solutions for small and large drops were combined to give explicit expressions for the maximum drop height and radius. These correlations apply for the complete range of liquid volumes and contact angles and are accurate to within 10% on drop height and 2% on maximum drop radius. (Author abstract modified)

395 APTIC NUMBER 16036

Becker, H. G.
MECHANISM OF ABSORPTION OF MODERATELY SOLUBLE GASES IN WATER. Ind. Eng. Chem., 16(12):1220-1224, Dec. 1924. 6 refs.

The absorption of oxygen and nitrogen in air-free water was studied under conditions allowing the absorption process to be followed step by step from zero concentration of dissolved gas to saturation in both mixed and unmixed liquids. Experiments are also reported on the absorption of other gases of widely different solubilities in unmixed water. When liquid is kept mixed, the solubility of oxygen and nitrogen diminishes with increasing temperature and the percentage saturaton of the liquid increases with time. Observations on the absorption of oxygen in liquid stirred at varying speeds indicate that absorption is proportional to time, i.e., the rate of solution is constant in water of zero oxygen content. When oxygen accumulates in the water, the rate of solution is proportional to the degree of unsaturation. In unmixed liquid, the rate of solution follows a regular course while the oxygen content of water is low, but becomes quite irregular when the water is 60 to 70% saturated. Gases such as carbon dioxide, hydrogen, and hydrogen sulfide form

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saturated layers at the surface of liquid, which cause the rate of solution to fall off rapidly. Gases such as nitrous oxide, nitric oxide, and chlorine show no tendency to form saturated surface layers and are absorbed at correspondingly higher rates.

396 APTIC NUMBER 17005

Bertoluzza, Alessandro, Giovanni Battista Bonino, Gianfranco Fabbri, and Vincenzo Lorenzelli
SOME RECENT RESULTS ON INFRARED SPECTRA OF ADSORBED MOLECULES. (Quelques resultats recents sur les spectres infrarouges des molecules adsorbees). Text in French. J. Chim. Phys., 63(3): 395-400, 1966. 22 refs.

Results of the infrared spectra of molecules adsorbed in silica-gel, aluminum chloride, and silica-alumina are presented. The study of frequency shifts between the vapor and the adsorbed states allowed the determination of the interacting groups. Information was obtained about the surface properties of the adsorbant and the nature of its active centers. Infrared spectra are presented for CH3COCH3 gas and CH3COCH3 adsorbed on s; CH3COCH3 gas and CH3COCH3 adsorbed on a; CH3COCH2Cl gas, CH3COCH2Cl liquid, and CH3COCH2Cl adsorbed on a; CH3COCl gas and CH3COCl adsorbed on a; CH3CN gas and CH3CN adsorbed on a; CH3-C (double bond O)-H gas and CH3-C (double bond O)-O adsorbed on a-s, transmission curves of s after absorption of H2O vapor; CHCl3 gas and CHCl3 adsorbed on a; intensity of components of the C double bond O of CH3-C (double bond O)-H adsorbed on a-s. Displacement to other frequencies and change of intensity of spectral lines of gas molecules after they are adsorbed on the surface of an adsorbent enables one to determine the groups involved in their bond structure and the energy associated with them, as well as to obtain information regarding the condition of the surface of the absorbent and the nature of its active centers. With respect to the transmission curves of CHCl3 gas and CHCl3 adsorbed on AlCl3 and the infrared spectra of CH3COCH3 gas and CH3COCH3 adsorbed on adsorbed on AlCl3, the interaction should, in principle, take place at Lewis' acid sites of the surface, that is, with Al atoms deficient in electrons. CHCl3, CH3COCH3, and CH3CH do, in fact, behave in that manner. The CHCl3 spectrum shows a well-defined splitting for the frequency of the valence vibration C-Cl and of the deformation vibration C-H as a result of adsorption, which is in accord with a lowering of the symmetry C3v by interaction with the Al atoms. The valence vibration C (double bond) O lowers its frequency to 1650 1/cm, much more than in the case of silica gel. This fact indicates a much more severe perturbation of the double bond which must correspond to strong a interaction between the carbonylic O and the Al atom.

397 APTIC NUMBER 16909

Bhatnagar, Vijay Mohan
CLATHRATE COMPOUNDS OF QUINOL. Defence Sci. J. (New Delhi), 13(4): 57-66, 1963. 77 refs.

The literature on the properties of the complex compounds formed by hydroquinone and certain volatile compounds is reviewed, and methods of preparing hydroquinone-inert gas clathrates are discussed. Special attention is given to Kr85. Although all the rare-gas clathrates provide the nuclear scientist with unique, new materials, Kr85 clathrates have the advantage of being safe and useful sources of beta radiation. To use Kr85 as a compact source of beta rays, the gas must be compressed in thick-wall containers that absorb much of its radiation. Quinol-Kr85 clathrate forms a stable and almost leak-proof container for the Kr atoms trapped in the crystals, and the crystals produce radiation 25 times as intense as that from equal volumes of Kr gas at atmospheric pressure. With its half-life of 10.3 years, Kr85 clathrate is a convenient energy source for a small atomic battery, and could be used as a phosphor exciter. It also makes possible the detection in parts per million of gaseous fluorine.

398 APTIC NUMBER 16154

Binns, Ferderick W. and Joseph M. Lurie
METHOD FOR MAKING BISULPHITE REACTIONS WITH SULFUR DIOXIDE ACID SOLUTIONS. (Virginia Smelting Co., Portland, Maine) U. S. Pat. 1,822,122. 3p., Sept. 8, 1931. (Appl. Dec. 15, 1926, 7 claims).

A method for effecting the reaction of sulfur dioxide with certain chemical compounds which are characterized by a tendency to decompose or to form intermediate reaction products which decompose, with the formation of a strong acid or acid radical, was described. The desired reaction was effected better with the use of an acid salt buffer. A practical application of the invention was described. Betanaphthol is dissolved in a caustic soda solution of NaOH. The solution is diluted with water, and sodium nitrite is added. Ice is also added to bring the temperature down to 5 C or below. Sulfuric acid is then added slowly. Upon standing, the nitroso compound which is formed separates from the solution as the reaction is completed. The second reaction is carried out in the presence of a buffer agent such as sodium hydroxide or sodium bisulfite which is added in very small proportions. A stream of sulfur dioxide gas is passed through the solution until the reaction is completed. The solution is then allowed to stand. Sulfuric acid is then added, which causes the formation of sulfonic acid which precipitates out as 1-amino-2hydroxy-4-naphthol sulfonic acid in a relatively pure form. This procedure is simple and highly efficient with regard to the reagents employed. The possibility of side reactions and contaminated by-products or unconverted starting materials are reduced.

399 APTIC NUMBER 15975

Blickle, Tibor, Janos de Jonge, Ferenczy Zoltan, and Pal Kaldi
THE OXIDATION OF SULFUR DIOXIDE WITH FLUIDIZED IRON OXIDE CATALYZER. (Kendioxid oxidalasa fluidizalt vasoxid-katalizatorral). Text in Hungarian. Veszpremi Vegyi. Egyet. Kozle., vol. 5:109-120, Feb. 1962. 3 refs.

Theoretical and experimental investigations were conducted on the decrease in the rate of sulfidation of iron oxide under fluidization conditions in excess of 500 C. It was found previously that the fluidized iron oxide is a better catalyzer than vanadium pentoxide because (1) higher rates of reaction can be achieved in the sulfur dioxide oxidation process, (2) the iron

oxide is less susceptible to catalyst-poisoning, and (3) iron oxide is more resistant to mechanical wear. The main drawback of iron oxide is that at its temperature limit of 620 C, where only 67.9% sulfur dioxide conversion takes place, the sulfidation of the iron oxide itself is very strong. The investigations show that even a slight amount of fluidization will prevent the sulfidation of the iron oxide. In the tests, the catalyzer was kept to 0.45 mm size, the gas flow contained 7% sulfur dioxide, 18.6% oxygen and 74.4% nitrogen at 450, 500, 550 and 600 C. The experimental reactor was a 3.8-cm diameter, chamotte cylinder surrounded by an electrical resistance heated oven. The paper defines the amount of fluidization by stating that the 0.45 mm catalyst particles were 'strongly' 'slightly' or 'not at all' fluidized. Regeneration of the iron oxide catalyst was also investigated in the fluidized-bed reactor; equations are given for calculating the time needed for regeneration of the catalyst. A theoretical equation derived for the nonfluidized catalyzer was found to be valid for the fluidized bed as well. The maximum amount of conversion was 90%.

400 APTIC NUMBER 17160

Blomgren, G. E. and E. R. Van Artsdalen
FUSED SALTS. Ann. Rev. Phys. Chem., vol. 11:273-306, 1960. 258 refs.

Recent advances in understanding the structure and chemistry of fused salts are reviewed. Precise methods employing improved techniques have become available for many different physical-chemical measurements; precise automatic control of temperature has become routine; and the preparation of high purity materials has been achieved. New techniques include vacuum studies, the use of inert atmospheres, and particularly electrolytic purification procedures. Recent very precise cryoscopic studies have contributed to our understanding of melts. The development of techniques for measuring self-diffusion in molten salts makes it possible to obtain properties. The development of x-ray techniques to elucidate structure of molten salts is a significant achievement, and the applications of various types of spectroscopy are beginning to yield important data, particularly with regard to the structure of complex ions. Improved analytical techniques have been developed. Finally, foundations are being laid for sound statistical and theoretical treatment of molten salts. These include development of equations of state and the determination of structure, transport, and thermodynamic properties. The principle subject headings of the review are transport properties (viscosity, electrical conductivity, transport numbers, diffusion, and thermal conductivity) and equilibrium properties (including among others, vapor pressure, electromotive force, solubility, density, surface tension, and spectroscopy and X-ray diffraction. (Author summary modified)

401 APTIC NUMBER 17207

Bockris, J. O'M. and W. E. Richards
THE COMPRESSIBILITIES, FREE VOLUMES AND EQUATION OF STATE FOR MOLTEN ELECTROLYTES: SOME ALKALI HALIDES AND NITRATES. Proc. Roy. Soc. (London), Ser. A, vol. 241:44-66, 1957. 49 refs.

Apparatus was devised to measure the velocity of ultrasonic vibrations through liquids at temperatures up to 1000 C by a phase-interference method. Velocities of sound through molten salts were measured up to a maximum temperature of 1000 C for LiCl, NaCl, KCl, CsCl, CdCl2, LiBr, KBr, CsBr, NaI, KI, LiNO3, and KNO3. Traces of water did not affect the velocities. The compressibility (Bt) increased approximately linearly with the square of the mean radius of the ions of the salts and with temperature. The free volumes (Vf) increased with increasing particle size and increasing temperature. From Bt, the internal pressures were calculated and a satisfactory equation of state was evaluated. Approximate values of the repulsive exponents in the equation for the energy of the liquid lattice varied from 9.9 (LiBr) to 12.5 (KBr). Comparison of the free volumes with the changes in volume on melting indicated that major role played by holes in the structure of these liquids. This was confirmed by the decrease of the coordination number observed on melting. A detailed model for the ionic liquid ws proposed and gave excellent agreement with experiment in respect to calculations of compressibility and expansivity. A modification of the sound-velocity method for the calculations was suggested, and the values of Vf, so calculated, were compared with those calculated from a method involving the equation of state and the internal pressure values. A relation between the hole volume and free volume was adduced and lended support to the model for molten salts. Consideration of the temperature coefficient of free volume gave conclusive evidence concerning the rate-determining step in viscous flow. The cell properties of the model were utilized together with the free volumes, to calculate partition functions. Evaluations using these of heat capacities and entropy changes were in agreement with the experiment. (Author abstract modified)

402 APTIC NUMBER 17013

Bonnemay, Maurice, Guy Bronoel, and Eugene Levart
CONCEPT AND ELECTROCHEMICAL STUDY OF AN ELEMENTARY MODEL OF A POROUS TRIPLE-CONTACT ELECTRODE. (Conception et etude electrochimique d'un modele elementaire d'electrode poreuse a triple contact). Text in French. Compt. Rend., 257(22-25):3394-3397, Nov. 1963. 8 refs.

The complex structure of porous electrodes, particularly of the so-called 'triple-contact' type, used at present in fuel cells, renders the study of processes which take place within them quite difficult, since the theoretical interpretation of electrochemical measurements requires knowledge of the specific geometrical features of the process in which they were obtained. To circumvent this difficulty, the random porous structure is commonly approximated by a fictitious tubular structure consisting of many close-packed mutually parallel thin-walled segmented tubes of the same size whose inner diameter and segment length are equal respectively to the mean diameter and the mean length of the pores. In employing this conceptual model, it suffices to study the electrochemical process in a physical realization of a single one of its tubular segments. It is essential to make this tubular segment sufficiently small, so that not only the mechanical effect of capillarity is duplicated, but also, as in the micropores, the entire gas/electrolyte interface is subjected to the capillary forces. Only then will the meniscus formed in this tube segment have the same contact angle as that existing in the pores

of such smaller diameter. The existing physical realizations do not satisfy this essential condition due to manufacturing difficulties of very thin metal tubes. These difficulties are avoided by using thin drawn glass tubing with a thin interior metal coating. In the example, the glass tube had an inner diameter of 0.2 mm, a wall thickness of 0.1 mm, and a length of 50 mm. The thickness of the interior silver layer produced by chemical metallization was a few micron and its surface was relatively rough, yet without any marked discontinuities. This capillary tube was used as one of the electrodes of a specially designed electrolytic cell with KOH as electrolyte described in the text and shown schematically. In tests carried out at about 20 C, the polarization was varied by means of a potentiostat in several steps, first in the negative, then in the positive sense. Each level of intensity was maintained for about 2 min, to allow a stationary condition to be attained at which an X-ray radiogram of the tube was made. These radiographs showed clearly the meniscus of the gas/electrolyte interface within the capillary electrode. The variation of the contact angle between the meniscus and the tube wall with the intensity and sense of polarization is illustrated.

403 APTIC NUMBER 13451

Booker, D. V., A. C. Chamberlain, and A. M. B. Scott
UPTAKE OF RADIOACTIVE LEAD FOLLOWING INHALATION AND INJECTION. Brit. J. Radiol., 42(498):457-466, June 1969. 14 refs.

Experiments have been made with human volunteers to determine the fate of Pb212 after inhalation. Two subjects inhaled Pb212 as a submicron aerosol and one also inhaled it as a vapor. The two subjects also received injections of Pb212 in saline solution so that the levels in blood following the two routes of entry could be compared. Measurements of the activity in excreta were made by gamma ray spectrometry. The activity removed from the lung had a half-life of about 10 hours. At 24 hours after inhalation about 3/4 of the particulate intially retained in the lung was found in the blood. Removal from the blood to permanent sites of deposition and by excretion was comparatively slow. When a vapor of Pb212 was inhaled, however, there was substantial fecal excretion. This is attributed to Pb212 deposited on the ciliated epithelium of the upper respiratory tract and subsequently brought up and swallowed. (Authors' abstract modified)

404 APTIC NUMBER 16678

Bratland, D., K. Grjotheim, C. Krohn, and K. Motzfeldt
SOLUBILITY OF CO2 IN MOLTEN SALTS AND ITS INFLUENCE ON CURRENT EFFICIENCY IN ALUMINUM ELECTROLYSIS. J. Metals, 19(10):13-20, Oct. 1967. 27 refs.

The solubility of carbon dioxide at atmospheric pressures in various simple alkali halides and cryolite-alumina mixtures was determined by stripping, volumetric, thermogravimetric, and 'chilling' methods. The results of the latter three methods are in satisfactory agreement. For the pure halides, a simple hole model for the liquids, originally used to correlate inert gas solubilities in various molten salt solvents, was applicable in the case of carbon dioxide. In cryolite-alumina mixtures, the carbon dioxide seems to react chemically to some extent with ionic species in the melt, effecting a higher solubility in these melts than in the pure halides. The influence of dissolved CO2 on the secondary reactions taking place during the aluminum electrolysis is discussed. (Author abstract modified)

405 APTIC NUMBER 17126

Braunstein, J. and M. Blander
THE THERMODYNAMICS OF DILUTE SOLUTIONS OF AGNO3 AND KCL IN MOLTEN KNO3 FROM ELECTROMOTIVE FORCE MEASUREMENTS. III. TEMPERATURE VARIATIONS OF THE ACTIVITY COEFFICIENTS. J. Phys. Chem., 64(10):10-13, Jan. 1960. 4 refs.

Activity coefficients and their temperature dependence as calculated from the quasi-lattice model of the molten reciprocal salt system A(+), B(+), C(-), and D(-), were tested by comparison with measured values of the activity coefficients of the component AgNO3 in the system Ag(+), K(+), Cl(-), NO3(-) dilute in Ag(+) and Cl(-) ions. Electromotive force measurements in a molten salt concentration cell were made at 385, 402, and 423 deg. KCl in solution lowered the activity coefficient of AgNO3; the decrease was directly proportional to the concentration of Cl(-) ions and inversely proportional to the concentration of Ag(+) ions. Results show that the temperature coefficients of the activity coefficients in the range of validity of the theory are correctly predicted, lending confidence in the usefulness of the quasi-lattice model. (Author abstract modified)

406 APTIC NUMBER 17147

Brian, P. L. T., J. F. Hurley, and E. H. Hasseltine
PENETRATION THEORY FOR GAS ABSORPTION ACCOMPANIED BY A SECOND ORDER CHEMICAL REACTION. Am. Inst. Chem. Engrs. J., 7(2):226-231, June 1961. 20 refs.

The penetration-theory solution for the effect of a second-order irreversible liquid-phase chemical reaction on the rate of gas absorption has been computed numerically on an IBM-704 computer. A linearized, time-centered, implicit finite-difference method was used to solve the nonlinear partial-differential equations. The method was very effective, permitting the solution of the equations for a wide range of the parameters of interest. The penetration-theory results are compared with the film-theory solution, and it is shown that the solutions to the two theories agree within 16% if they are compared for conditions which produce the same asymptotic solution for an infinitely rapid chemical reaction. A simplified equation and some correction charts are presented which permit a rapid, accurate estimation of the penetration-theory solution over a wide range of variables. (Author abstract modified)

407 APTIC NUMBER 16700

Bright, J. Russell and Joseph J. Jasper
MOLECULAR SURFACE ENERGY OF SULFUR DIOXIDE ADDITION COMPOUNDS. J. Am. Chem. Soc., vol. 65:1262-1263, July 1943. 8 refs. (Presented at the American Chemical Society Meeting, Physical and Inorganic

Chemistry Division, Memphis, Tenn., April 1942.)

The effect of temperature on the molecular surface energy of the stable addition compound of sulfur dioxide with triethylamine was determined by density, surface tension, and viscosity measurements at 0 to 30 deg. A straight line relationship was found for both density and surface tension. These relationships, as determined by least squares were as follows: density equals 1.0640 - 000.985t, and surface tension equals 38.235 - 0.1376t. Both the density and surface tension of this compound were substantially greater than those of trimethylamine. The average value of 3.27 for the Eotvos constant was greater than the average value of 2.12 for nonpolar liquids but less than the 4.61 average reported for addition compounds of dimethylaniline with sulfur dioxide. At room temperature, the viscosity of the sulfur dioxide-triethylamine compound decreased about 2% for each degree rise in temperature. At 0 deg, the decrease was much more marked. Parachor data furnished additional evidence for the existence of a nitrogen to oxygen to sulfur linkage in this type of compound.

408 APTIC NUMBER 16915

Bright, J. Russell and Joseph J. Jasper
MOLECULAR SURFACE ENERGY OF SULFUR DIOXIDE ADDITION COMPOUNDS. I. J. Am. Chem. Soc., vol. 63:3486-3488, Dec. 1941. 8 refs. (Presented at the American Chemical Society Meeting, Division of Physical and Inorganic Chemistry Atlantic City, N. J., Sept. 1941.)

Density and surface tension measurements for the readily dissociated addition compound of sulfur dioxide with dimethylaniline were made at 0 to 30 deg. Equations of the curve were derived for the effect of temperature on density and surface tension. They show that the density and surface tension of this compound are substantially greater than for dimethylaniline. The presence of complicated molecules is shown by the high values of the Eostvos constants. Molecular volumes of the compound are less than values obtained by adding the molecular volume of liquid sulfur dioxide and dimethylaniline, suggesting the probable polar nature of the addition compound. Parachor values indicate a nitrogen to oxygen linkage in the compound.

409 APTIC NUMBER 16903

Bright, J. Russell and W. Conard Fernelius
TEMPERATURE-CONCENTRATION EQUILIBRIA IN THE SYSTEM DIMETHYLANILINE-SULFUR DIOXIDE. J. Am. Chem. Soc., vol. 65:637-639, April 1943. 6 refs. (Ohio State Univ., Columbus, Thesis (PhD), June 1940).

In a study of the temperature-concentration equilibria in the system sulfur dioxide-dimethylaniline, pressures were measured with a manometer and temperatures, with a thermocouple. Cooling curves were obtained directly with a recording potentiometer. The study identified and isolated the addition compound C6H5(CH3)2N:SO2 whose congruent melting point is near 12.6 deg. Considerable dissociation of the compound occurs at its melting point, but the compound is reasonable stable over short periods of time. Cryoscopic molecular weight measurements of the compound indicate some association at low concentrations. The degree of association increases with increasing concentration. Tabulated temperature-composition data of the system C6H5(CH3)2N-SO2 show the formation of the compound C6H5(CH3)2N:SO2, dimethylaniline-sulfur dioxide. A temperature-concentration diagram was obtained from the data. Further temperature-composition data are presented for the system C6H5(CH3)2N:SO2-NC6H5(CH3)2. This data can be used to calculate the molecular weight of the addition compound in dimethylaniline at several concentrations.

410 APTIC NUMBER 17014

Brouillet, Philippe, Alfred Grund, Fernand Jolas, and Robert Mellet
ELECTROCHEMICAL REDUCTION OF MANGANESE DIOXIDES OF THE GAMMA TYPE. (Sur la reduction electrochimique des bioxydes de manganese variete gamma). Text in French. Compt. Rend., 257(22-25):3390-3393, Nov. 1963. 3 refs.

If one accepts the constitutive formula of the dioxides of manganese of type gamma; the electrochemical reduction of its components takes the form of a continuous change of the degree of reduction from some value, in sub 0, towards a higher value, n. Disregarding the water bound to the Mn dioxide of type gamma, this transformation can be written in the form: Mn(IV(1-n sub 0)) Mn(III(2-n sub 0))((OH(n sub 0)) + (n-n sub 0)H(+) + (n-n sub 0)e(-) gives Mn(IV(1-n))Mn(III(2-n)) O(2-n)((OH)(n)) where 0 smaller than n sub 0 smaller than n smaller than or equal to 1. Protons originating in the solution penetrate into the crystal lattice, while the electrons supplied by the external circuit change the valency of an equivalent number of Mn atoms from IV to III. Since the electrons can move about freely in the solid phase, the resulting accumulation of protons in the surface layer of the crystal lattice leads to a diffusion of protons from this layer into its interior which controls the rate of the electrochemical reaction. On this hypothesis it is possible to represent analytically the variation of the voltage, eta, on an electrode of Mn dioxide of type gamma and of the apparent current density, J, as functions of each other and of time, T, under four different electrical conditions imposed on the electrode.

411 APTIC NUMBER 16667

Burkhard, William J. and John D. Corbett
THE SOLUBILITY OF WATER IN MOLTEN MIXTURES OF LICL AND KCL. J. Am. Chem. Soc., vol. 79:6361-6363, Dec. 20, 1957. 10 refs.

The solubility of water in molten mixtures of 50.0, 53.0, 60.0 and 68.6 mole % lithium chloride (LiCl) in potassium chloride (KCl) has been determined at 480 deg, and 50.0 and 60.0% at 390 deg over the pressure range 3 to 26 mm. The solubility follows Henry's law to 18 mm at 480 deg and 14 mm at 390 deg. The reciprocal Henry's law constants are, respectively, 14, 11.8, 11.3 and 10.8 microsoles water per mole LiCl per mm at 480 deg and 30.0 and 30.5 at 390 deg. Heats of solution of -8 and -11.0 kcal/mole are calculated for the 50 and 60% compositions, respectively. The solubility at 480 deg exhibits a sharp upward break beyond 18 mm due to hydrolysis of the LiCl at the higher water pressures. At 390 deg no such behavior is observed, but only a slight upward deviation above about 14 mm. The uniqueness of the lithium ion in this process, and the unusual tenacity with which water is

retained by the melt are discussed. (Author abstract modified)

412 APTIC NUMBER 16034

Campbell, K. I., W. L. Crider, H. J. Knott, and H. Malanchuk
ALIEN CONSTITUENTS IN EXPERIMENTAL ATMOSPHERES. Preprint, Aerospace Medical Research Lab. (6570th), Wright-Patterson AFB, Ohio, 15p., 1969. 8 refs. (To be submitted for publication in Proceedings, 5th Annual Conference on Atmospheric Contamination in Confined Spaces.)

The formation of unintentional particulate material during chamber inhalation toxicity studies in which dogs were exposed to nitrogen dioxide with and without ferric oxide dust was investigated. Eight Beagles were exposed to 20-30 ppm NO2 with and without 0.8-1.0 mg/cu m Fe2O3 in the chambers. It was noticed during particulate monitoring that the combined presence of dogs and NO2 contributed substantially to the aerosol loading in the chamber. The extraneous aerosol response was more than twice that which represented the Fe2O3 concentration. In all analyses of samples of significant quantity, nitrate and ammonium ions were relatively abundant while nitrite salts were absent. The observations indicated the presence of particulate matter in excess of certain planned atmospheres, and suggest physical constituents and/or chemicals as a source. Some of this is likely to be respirable. Under certain conditions, a substantial portion of the alien material was nitrogen-bearing, and ammonium nitrate probably assumed a major role. During a study to assess the inhalation toxicity of ozone and employing the same exposure chambers, particulate counts were made with and without dogs and/or ozone. Data suggested that dogs interact with and reduce ozone introduced into the exposure chambers. Ozone appeared to react with chamber atmospheres even in the absence of dogs to produce alien particulate material. Aerosol counts of 18-73% were observed when ozone was introduced to chambers without dogs. Introduction of the same ozone levels increased total particulate counts 11-81% when dogs were in the chambers. Concentrations of ozone and NO2, when introduced singly and in combination, were determined for the establishment of standard operating conditions to be used in animal exposure studies. While no appreciable chamber loss was observed with ozone and NO2 introduced singly, in combination ozone was reduced by 63 and 69% at expected concentrations of 1.1 and 3.2 ppm; corresponding NO2 losses were 13 and 31% at expected concentrations of 9.9 and 14.6 ppm.

413 APTIC NUMBER 17099

Castellani Bisi, Carla and Mario Cola
THERMAL DECOMPOSITION OF CERTAIN METALLIC SULFITES. PART 3. SULFITES OF LANTHANUM AND SAMARIUM. (Decomposizione termica di alcuni solfiti metallici. Nota III. Solfiti di lantanio e samario). Text in Italian. Gaz. Chim. Ital., vol. 92:447-453, 1962. 5 refs.

Lanthanum and samarium sulfites, when heated in an inert atmosphere, enter into dismutation and dissociation reactions. The two main reactions are accompanied by secondary ones caused by the presence of water of crystallization, which it is impossible to eliminate completely.

414 APTIC NUMBER 17100

Castellani Bisi, Carla and Aldo Clerici
THERMAL DECOMPOSITION OF CERTAIN METALLIC SULFITES. PART 5. SULFITES OF SCANDIUM, YTTRIUM, LANTHANUM, NEODYMIUM, AND SAMARIUM. (Decomposizione termica di alcuni solfiti metallici. Nota V. Solfiti di scandio, ittrio, lantanio, neodimio, samario). Text in Italian. Gaz. Chim. Ital., 93(11):1444-1454, Nov. 1963. 13 refs.

Scandium and yttrium sulfites, when heated in a stream of nitrogen, do not exhibit the classical reaction of dismutation to sulfate and sulfide, but decompose to form sulfur dioxide, the lower oxides of sulfur (SO, S2O), and the oxide and sulfate of the metal. The same type of reactions are fundamental to the thermal decomposition of the sulfites of lanthanum, neodymium, and samarium, although in these cases the classic dismutation to sulfide and sulfate is present to some extent.

415 APTIC NUMBER 17104

Castellani Bisi, Carla and Erminia Res Garrini
THERMAL DECOMPOSITION OF CERTAIN METALLIC SULFITS. PART 4. SULFITES OF POTASSIUM, LITHIUM, AND AMMONIUM. (Decomposizione termica di alcuni solfiti metallici. Nota IV. Solfiti di potassio, litio, ammonio). Text in Italian. Gaz. Chim. Ital., 93(10): 1252-1258, Oct. 1963. 9 refs.

Thermal decomposition of potassium and lithium sulfites in an inert environment and at atmospheric pressure occurs essentially by means of a dismutation to sulfate and sulfide; such a process can be verified for ammonium sulfite in a closed environment, in this case accompanied by complex side reactions. In the temperature range 800-950 C, potassium sulfite decomposes in complete accord with the dismutation reaction to sulfate and sulfide. Above 950 C, the amount of sulfide formed begins to decrease. For lithium sulfite, the dismutation range is 650-900 C. The decomposition of ammonium sulfite results in a product of a dard orange color, which becomes rapidly discolored in the air or in an alcoholic or aqueous environment, resulting in the loss of ammonia and hydrogen sulfide gases and the abundant formation of elemental sulfur. The presence of sulfides, sulfates, and thiosulfates is also detected. The orange color and the formation of elemental sulfur suggest the presence, at least initially, of ammonium polysulfide. The increase in thiosulfate with time suggests a reaction between the free sulfur and the sulfite residue.

416 APTIC NUMBER 17112

Conrad, Frank H. and W. L. Beuschlein
SOME EQUILIBRIUM RELATIONS IN THE SYSTEM CALCIUM OXIDE-SULFUR DIOXIDE-WATER (ACID REGION) AT PRESSURES BELOW ATMOSPHERIC. J. Am. Chem. Soc., vol. 56:2554-2562, Dec. 1934. 15 refs.

The system CaO-SO2-H2O is significant because of the extensive use of the sulfite process in manufacturing wood pulp. The raw acid from absorption towers is essentially such a system. The

total pressure-composition relationships were determined for the system in the acid region up to a total pressure of one atm and 15 and 25 C. The solid phase in equilibrium with the solutions at the pressures investigated was identified as containing CaO and SO2 in the molar ratio 1:1; the compound 2CaSO3-H2O is indicated. The total free and combined sulfur dioxide was determined for saturated solutions in equilibrium with solid calcium monosulfite at total pressures of sulfur dioxide and water vapor from the vapor pressure of water to atmospheric pressure for 15 and 25 deg. The total temperature-composition relationship was also determined for the total pressure of 761 mm at 15, 25, and 35 deg. The total free and combined sulfur dioxide in a solution formed by the reaction of aqueous Ba(OH)2 and SO2 in which solid was present was determined for the temperature of 25 deg and total pressures of 659 mm. The results are presented in the form of tables. (Author conclusions modified)

417 APTIC NUMBER 16997

Conrad, Frank H. and Donat B. Brice
THE SOLUBILITY OF SULPHUR DIOXIDE IN MAGNESIUM BISULPHITE SOLUTIONS. Tappi, 32(5):222-226, May 1949. 9 refs. (Presented at the Annual Meeting of the Technical Association of the Pulp and Paper Industry, New York, N. Y., Feb. 21-24, 1949.)

Since certain sulfite pulp mills are converting to magnesium base pulping, it is important to know the solubility of sulfur dioxide in various base concentrations at different pressures and temperatures. For this purpose, equilibrium data for the system magnesium oxide-sulfur dioxide-water at 15 and 25 C at pressures below atmospheric were combined with previously obtained values of SO2 at 500 mm partial pressures in the form of p-t-z diagrams for the range of commercial cooking liquors. The diagrams represent the solubilities of sulfur dioxide, together with extrapolated saturation values, at temperatures from 5 to 60 C and at partial pressure up to 700 mm Hg.

418 APTIC NUMBER 16946

Crawford, V.
INFRARED SPECTRA OF ADSORBED GASES. Quart. Rev. (London), vol. 14: 378-401, 1960. 61 refs.

A literature review is presented to illustrate how spectroscopic methods may be used to contribute towards elucidating certain general problems of adsorption; examples are chosen from some of the solid-gas systems which have been studied. Under physical absorption, the type of information that can be obtained from a study of the infrared spectra of absorbed molecules are indicated, as well as the experimental requirements necessary to obtain well-defined spectra. Perturbation of the surface by the adsorbate should be detected very easily if the surface possesses functional groups; perturbation of the adsorbate by the surface is also discussed at length. Topics reviewed under chemisorption are surface homogeneity, the mechanics of chemisorption with application to ethylene, and effect of the support. Current knowledge relates almost exclusively to gases either physically adsorbed on high-area silica or chemisorbed on silica-supported metals and metal oxides. Since spectroscopic evidence exists indicating that the support is not inert, it is considered imperative that it be determined to what extent the observed effects can be attributed to interaction between the adsorbate and the adsorbent, before the spectroscopic results obtained for gases adsorbed on supported metals can usefully be compared with the results obtained on evaporated metal films.

419 APTIC NUMBER 17302

Dahlberg, Jan Anders
THE NON-SENSITIZED PHOTO-OXIDATION OF TRICHLOROETHYLENE IN AIR. Acta Chem. Scand., 23(9):3081-3090, 1969. 15 refs.

The nonsensitized photooxidation of trichloroethylene was kinetically investigated. The results can be interpreted in terms of a chain reaction which is probably initiated by a reaction between an excited trichloroethylene molecule and another trichloroethylene molecule in the ground state. The chain reaction yields mainly dichloroacetyl chloride, the maximum quantum yield of which is found to be about 20 at high partial pressures of trichloroethylene and oxygen. The quantum yield of phosgene is about one-fifth that of dichloroacetyl chloride. (Author abstract modified)

420 APTIC NUMBER 17271

Davydov, A. A., Yu. M. Shchekochikhin, and M. P. Keyer
OXIDATION OF CARBON MONOXIDE OVER CHROMIC OXIDE EXAMINED BY INFRARED SPECTROSCOPY. (Izucheniye mekhanizma okisleniya okisi ugleroda na okisi khroma metodom infrakrasnoy spektroskopii). Text in Russian. Kinetika i Kataliz, 10(6):1342-1349, 1969. 13 refs.

Reaction of carbon monoxide, carbon dioxide, and a carbon monoxide-oxygen mixture with an oxidized and degassed chromic oxide surface was studied using IR-spectroscopy. Reaction with an oxidized surface begins at lower temperatures than with a degassed surface. Adsorption of CO onto an oxidized surface leads to the formation of surface carbonate-carboxylate compounds. The breakdown temperature of the structures formed is determined by the binding strength between the atoms of adsorbed oxygen which enter into the structure of these compounds and the surface. A drop in the desorption temperature for carbonate-carboxylate surface structures was detected with oxidation of CO to CO2 under static conditions. The mechanism of CO oxidation to CO2 over chromic oxide is discussed.

421 APTIC NUMBER 17310

de Mauduit, Yves and Guy M. Weinreich
RAMAN SPECTOMETRIC INVESTIGATION OF THE BINARY SYSTEM SULFUR DIOXIDE-SULFUR TRIOXIDE. (Etude de systeme binaire dioxyde-trioxide de soufre par spectrometrie Raman). Text in French. Rev. Chim. Minerale, 6(5):927-932, 1969. 13 refs.

Raman spectra of SO2-SO3 solutions covering the entire range of

concentrations from 0 to 100% SO3 were recorded at the temperature of 21 plus or minus 1 C with a Huet B50 spectrometer using a He-Ne laser, equipped with a photo multiplier and a potentiometric recorder. A preliminary study of the Raman spectrum of SO2 confirmed, with an accuracy of plus or minus 2 1/cm, its three characteristic lines at 526, 1146, and 1338 1/cm reported previously by Gerding. The 1146 1/cm - line is very strong and was utilized in the study of Raman spectra of the SO2-SO3 solutions. A record of the Raman spectrum of SO3, distilled three times and kept liquid for three months is shown. In contrast to previously published Raman spectra displaying the characteristic lines of its monomer and trimer forms, the lines at 330 and 840 1/cm are absent here, and are tentatively attributed to traces of poly-sulfuric acids remaining in SO3 samples prepared by other methods. A study of the Raman spectra of the 18 SO2-SO3 solutions yielded the following findings: no new spectral lines were discovered; no line displacements could be found within the accuracy of the measurements; the intensities of the spectral lines, particularly that of the line at 1072 1/min attributed to the SO3 monomer, did not remain constant as the composition changed, but did not vary monotonically with the SO3-content; and the set of lines attributed to the SO3 trimer, the two most intense ones of which are at 372 and 1271 1/cm, was present only when the SO3 content was higher than 33.3 mole %. The mode of variation of the spectral lines with the SO3 content is brought out quite clearly by plotting the ratio of the intensity of the line at 1072 1/min characteristic of the SO3 monomer and the sum of the intensities of that line and the line at 1146 1/min characteristic of SO2, against the SO3 content, as shown by a curve which abruptly changes its scope at 33.3 mole % SO3 as well as less pronouncedly at 66.7 mole % SO3. This latter blurring of the kink is likely to be due to an 'aging' of the test specimens with a concomitant change of the intensities of the spectral lines previously observed. The present results confirm that there are two molecular associations: 2(SO2)-SO3 and SO2-2(SO3) which form in the SO2-SO3 solutions. The first of these is definitely formed with the SO3 monomer, thus providing the explanation of the phenomenon of spontaneous depolymerization of SO3 in dilute solutions in SO2.

422 APTIC NUMBER 15833

Decius, J. C.
INFRARED FREQUENCIES AND INTENSITIES OF SULFATE ION IMPURITIES IN KBR CRYSTALS AND THE THEORY OF THE VIBRATIONAL STARK EFFECT DUE TO INTERNAL FIELDS. Spectrochim. Acta, 21(1):15-22, 1965. 5 refs.

The complete fundamental spectra of CaSO4, SrSO4, and BaSO4 ion pairs in KBr are presented. All eight fundamental modes allowed for a sulfate ion under C(2u) (u stands for upsilon) selection rules were found in specimens of KBr doped with CaSO4, SrSO4, and BaSO4. This indicated the formation of ion pairs in which M(2+) and SO4(2-) occupy nearest neighbor positions in the rocksalt lattice. Other species of sulfate were observed, but were incompletely identified. The splitting of the triply degenerate modes v3 and v4 (v stands for frequency, nu) was treated on the basis of a vibrational Stark effect arising from the intense electric field due to the excess charge on the alkaline earth ion. The theory relates the splittings to the anharmonic constants in the potential function of SO4(2-), and to the dipole derivatives of the infrared active modes. Although there are too many parameters for a complete solution, the order of magnitude of the cubic potential constants as estimated from the observed splittings is shown to be very reasonable. (Author abstract modified)

423 APTIC NUMBER 16660

Dhindaw, B. K. and S. C. Sircar
KINETICS AND MECHANISM OF SULFATION OF ZINC OXIDE. Trans. AIME (Am. Inst. Mining, Metallurgical, and Petroleum Engr.), 242(8): 1761, Aug. 1968. 4 refs.

The mechanism and kinetics of the sulfation of zinc oxide powder were studied by a gravimetric technique, using a spring of high-carbon steel wire with an accuracy well within 0.2 mg for measuring weight change, an oxygen flow of 60 cu cm/min, and sulfur dioxide flow of 45 cu cm/min. The plot of weight change of ZnO, giving the amount of ZnO formed, was found to be linear over the 500-700 C temperature range and up to a conversion of about 60%; beyond these points, they divert from linearity. The rate of sulfation was affected by total flow rate of gases at a fixed ratio of SO2/O2, up to 60 cu cm/min, and was linearly dependent on the quantity of total powdered sample taken. The plot of rate of sulfation of ZnO, 70 mg, with varying amounts of vanadium pentoxide, at a constant ratio of gases as given above and at a constant temperature of 625 C was also found to be linear. The most widely accepted theory of the mechanism of sulfation is noted, and it is suggested that the rate-controlling step in the sulfation reaction of ZnO is the formation of SO3 from SO2 and O2.

424 APTIC NUMBER 16676

Dietz, Albert G. H.
COMPOSITE MATERIALS. Baltimore, American Society for Testing and Materials, 1965, 55p. 163 refs. (1965 Edgar Marburg Lecture.) (Presented at the 68th American Society for Testing and Materials Ann al Meeting, West Lafayette, Ind., June 16, 1965.)

Composites, combinations of several materials acting in concert, are called upon to provide properties unattainable in the constituents by themselves. The combined action is frequently of a different order of magnitude, or quite different in character, from the behavior of the constituents. Composites take many forms. They may consist of particles or fibers distributed in a matrix, they may be layered materials laminated together, and they may be organic, metallic, ceramic, or combinations of these. Traditional categories of materials being broken down as new combinations, often with materials heretofore considered to be incompatible, are sought to provide answers to new problems. Numerous charts, graphs, and illustrations are given. It is concluded that many problems remain to be solved, science and engineering will be taxed to the utmost to find the answers, but the performance already attained is a bright promise for the future.

425 APTIC NUMBER 16984

Dillon, G. B. and I. J. Harris
THE DETERMINATION OF MASS TRANSFER COEFFICIENTS AND INTERFACIAL AREAS IN GAS-LIQUID CONTACTING SYSTEMS. Can. J. Chem. Eng., 44(6):307-312, Dec. 1966. 21 refs.

Experimental studies of absorption with and without reaction in a single orifice bubble contactor and on a sieve plate are applied to the determination of mass transfer coefficients and/or interfacial areas over a wide range of gas rates, including rates resulting in the generation of bubble swarms and froths. The basic apparatus consisted of a bubble column and gas and liquid circuits with suitable devices for regulating and metering the gas and liquid flow rates to the column. The desorption of carbon dioxide from water by an air stream was used for the measurement of the liquid phase mass transfer characteristics, since this system is a completely physical process satisfying the requirement of slight gas solubility; the system also possesses a convenient analytical method for measuring the amount of transfer. The theoretical basis of the approach is developed, and the limitations of the method are discussed. The results compare well with published data obtained by other techniques, and the method can be used where direct physical measurement of interfacial area is not possible. In comparison to light scattering and photographic techniques, this method can be applied to contacting systems containing a large number of orifices, e.g., a sieve plate.

426 APTIC NUMBER 17143

Dworkin, A. S., H. R. Bronstein, and M. A. Bredig
THE ELECTRICAL CONDUCTIVITY OF SOLUTIONS OF METALS IN THEIR MOLTEN HALIDES. VII. RARE EARTH METAL SYSTEMS. ELECTRON EXCHANGE BETWEEN ADJACENT OXIDATION STATES. J. Phys. Chem., 67(12):2715-2717, Dec. 1963. 8 refs.

The electrical conductivities of solutions of the series lanthanum, praseodymium, and neodymium in their molten tribromides are similar to those of the corresponding chloride and iodide systems. The rapid increase in conductivity with metal concentration in the La solutions indicates the occurrence of considerable electronic conductance, e.g., in a solution of 10% La metal, as high as nine times the ionic conductance. The Nd solutions show little if any electronic conductance, while the Pr solutions are again intermediate. Solutions of gadolinium, dysprosium, holmium, and erbium in their molten trichlorides behave irregularly both in regard to solubility and electrical conductance. The results of the specific conductivity measurements of the pure tribalides are summarized, as well as the specific conductivity measurements for the metal-in-salt solutions. The increase in conductivity on addition of metal to the bromide is intermediate between that found for the chlorides and iodides. This is unlike that situation noted upon addition of the alkali and alkaline earth metals to their halides where the iodide systems appeared to have a lower conductivity than expected. The different behavior of the rare earth iodide systems may have some relation to the formation of metal-like solid diiodides. (Author abstract modified)

427 APTIC NUMBER 15628

Dzhafarova, M. M.
MEASUREMENT OF THE ADHESIVE STRENGTH OF DUST LAYERS TO INSULATOR SURFACES. (Izmereniye sil prilipaniya pylevykh sloyev k poverkhnosti izolyatorov). Text in Russian. Elek. Sta., no. 10: 61-62, 1969.

A simple mechanical device for determining the adhesive strength of a dust layer on high-voltage glass insulators is described. Tests indicate that measurement results are sufficiently accurate for practical purposes. The measured adhesive strength is an indication of the ability of a given type of deposit to remain on the insulator and thereby reduce the discharge voltage as this deposit becomes moist. These measurements may also be used to characterize the dust present in the air along the route of a transmission line.

428 APTIC NUMBER 17165

Engelhardt, H. and H. Sack
THE INFLUENCE OF A MAGNETIC FIELD ON THE INTERNAL FRICTION OF O2. (Beeinflussung der inneren Reibung von O2 durch ein Magnetfeld). Text in German. Physik. Z., vol. 23:724-727, 1932. 6 refs.

The change of the viscosity of O2, air, and H2 by a magnetic field between 0 and 2000 Gauss was determined with an aerodynamic Wheatstone bridge as a function of the gas pressure. An influence could be determined for O2 at higher pressures, which at 268 mm Hg and 2000 Gauss was already rather weak and had disappeared completely at a pressure of 600 mm. The influence of the magnetic field reduced the viscosity. With air, considerably lower influences were determined; with H2, no influence at all of the magnetic field could be observed.

429 APTIC NUMBER 16923

Erdos, E.
THERMODYNAMIC PROPERTIES OF SULPHITES. II. ABSOLUTE ENTROPIES, HEAT CAPACITIES AND DISSOCIATION PRESSURES. Collection Czech. Chem. Commun. (Prague), vol. 27:2273-2283, 1962. 6 refs. Part I. Ibid., vol. 27:1428, 1962.

A modification of the Latimer method for calculating the absolute entropies of salts is described which reproduces the entropies of sulfates and carbonates with an average deviation of plus or minus 0.64 eu. A method is also suggested for calculating the heat capacities of solid salts with an average deviation of plus or minus 0.14 cal/grad mole. The entropies, heat capacities, and dissociation pressures of 31 sulfites are calculated and the results are discussed in terms of their possible application for the removal of sulfur dioxide from flue gases. It is shown that partial sulfur dioxide pressures between 0.1 and 0.0001 represent the working range of assumed equipment for the sulfur dioxide removal. The upper limit corresponds to atmospheric pressure to a content of 0.1% vol of sulfur dioxide in flue gases and the lower limit to the state after purification up to 99%. The dissociation pressures of sulfites, of alkali metal of metals of alkaline earths and thalium, and of Ag, Co, Cd, Mn, Hg, and Pb

are safely below the pressure range at any temperature intervals from 0 to 300 C. Other metal sulfites exhibit dissociation pressures which pass through the range of partial pressures at a given temperature, and their application for sulfur dioxide removal appears somewhat problematic. (Author abstract modified)

430 APTIC NUMBER 16649

Feigl, F. and E. Feigl
TERNARY COMPOUNDS OF SO2 WITH KETONES AND AMINES. (Ueber ternaere Verbindungen von SO2 mit Ketonen und Aminen). Text in German. Z. Anorg. Allgem. Chem., vol. 203:57-63, 1932. 3 refs.

To find out whether the compounds described by Boessneck such as CO(CH3)2SO2C6H5NH2, SO(CH3)2SO2C6H5NHC2H5 and CO(CH3)2SO2C6H5N(CH3)2 are links of a larger class of ternary molecular compounds, primary, secondary, tertiary, open and cyclic amines were treated with various types of ketones and with sulfur dioxide under comparable conditions. Compounds consisting of one mol amine and ketone to one mol SO2 could be isolated, e.g., alpha-naphtylamine-SO2-acetone; benzidin-SO2-acetone; benzidine-Se-Acetone; pyridine-SO2-acetone, etc. It was found that primary, secondary, and tertiary amines could be added equally well to ketones and SO2. Selenium dioxide acts like SO2. The oxygen atom of the ketone and the nitrogen atom of the amine are the centers of addition. The formation of such ternary compounds is obviously based on the fact that the sulfur atom of the SO2 is able to bind two types of molecules in order to reach the coordination number 4. Other amines than those named above were tested as to their ability of forming compounds to determine whether a weakening of the alkaline character of the amine is of influence. It was found that diphenylamine, triphenylamine, 2,4-dinitraniline, carbazol, 2,4,6-tribromaniline and others are not able to form ternary compounds. This is explained by inner molecular saturation of the nitrogen atom or by the presence of strongly negative groups.

431 APTIC NUMBER 17105

Fiocchi, R.
DEGREE OF EFFICIENCY IN SEPARATING MIXTURES OF NONISOTOPIC GASES BY DIFFUSION. COMPARISON OF THE CAPILLARY AND GRANULAR THEORIES OF POROUS BARRIER. (L'efficienza della separazione nella diffusione di miscele gassose non isotopiche. Confronto tra modello capillare a modello granulare della barriera porosa). Text in Italian. Energia Nucl. (Milan), 12(7):372-377, July 1965. 8 refs.

The theory recently elaborated by Briton and Hassignon and applied by them to the calculation of the separation of heavy isotopes is applied to the separation of nonisotopic gas mixtures by diffusion across a porous barrier. When this is compared with the capillary theory of Present and Bethune, one sees how the representation of the porous barrier as an accumulation of spherical particles--better in accord with the actual structure of the barrier--gives results that agree more closely with the experimental data than one can obtain by means of the capillary representation of the barrier.

432 APTIC NUMBER 16955

Foote, H. W. and Joseph Fleischer
EQUILIBRIUM IN SYSTEMS COMPOSED OF SULFUR DIOXIDE AND CERTAIN ORGANIC COMPOUNDS. J. Am. Chem. Soc., vol. 56:870-873, April 1934. 8 refs.

Vapor pressure measurements were made on the two-component systems formed by sulfur dioxide with aniline, methylaniline, ethylaniline, diethylaniline, diphenylamine, p-toluidine, naphthalene, diphenyl, diphenyl ether, alpha- and beta-naphtols, and ethylene glycol between the maximum temperature limits -20 and 30 deg. When sulfur dioxide was passed into aniline at room temperature, the liquid immediately attained a dark orange-red color and a bright yellow solid was precipitated. A saturated solution of this compound was formed by condensing an excess of sulfur dioxide at -20 deg, the solution having a pale yellow color at this temperature. A solid addition compound melting congruently to a clear orange-red liquid at a temperature close to 31 deg was formed in the methylaniline system. The ethylaniline system was almost identical to the methylaniline system, and the melting point of the 1:1 compound was 29 deg. No solid compound was found in the diethylaniline system at temperatures above -20 deg. The two liquids were miscible in all proportions and the solutions had a deep purple-red color. A solid compound could be obtained by lowering the temperature sufficiently. Diphenylamine was readily soluble in liquid sulfur dioxide, yielding deep purple-red solutions. No solid addition compound exists above -20 deg. A solid, bright yellow compound was formed on treating p-toluidine with liquid sulfur dioxide. Neither naphthalene nor diphenyl formed solid addition compounds with sulfur dioxide at temperatures above 0 deg. In both cases, the saturated solutions were greenish-yellow in color. Although phenol was reported to form a solid addition compound with sulfur dioxide, neither alpha- nor beta-naphthol gave any evidence of forming any solids above -20 deg. Both are insoluble in liquid sulfur dioxide, producing orange colored solutions. No solid addition compound existed above -20 deg for diphenyl ether. Ethylene glycol was miscible with liquid sulfur dioxide above -20 deg, and gave colorless solutions.

433 APTIC NUMBER 16788

Foster, P. M.
THE OXIDATION OF SULPHUR DIOXIDE IN POWER STATION PLUMES. Atmos. Environ., 3(2):157-175, March 1969. 12 refs.

Some theoretical estimates are made of the rate of growth of H_2SO_4 droplets nucleated by $MnSO_4$ crystallites in a humid, SO2 polluted atmosphere. Comparison with experiment suggests that, as the acid concentration within the droplet rises, the rate of growth decreases as a result of the product acid affecting the rate of SO2 oxidation. For this reason the amount of droplet growth, and the amount of SO2 oxidation, is very sensitive to the ambient humidity, and will be greatest for saturated or very high relative humidities where droplet acid concentrations are restricted to low values. Similar calculations relating to the dusty conditions present in power station plumes are also made. These show that the rates of SO2 oxidation observed in these systems can be accounted for by the catalytic qualities of the iron present in the effluent dust. It is suggested that other

oxides present also play an important part in this process in that they react with the product acid as it is formed, thus keeping the droplet in a neutral condition in which the catalyst is most active. (Author's Abstract)

434 APTIC NUMBER 17146

Francini, M., S. Martini, and C. Monfrini
OSCILLOGRAPHIC POLAROGRAPHY IN MOLTEN NITRATES. IV. THE HALIDE IONS BEHAVIOR. Electrochim. Metal., 2(3):325-335, 1967. 16 refs.

Electro-oxidation of the halide ions dissolved in molten nitrate mixtures at dropping and stationary mercury electrodes were oscillopolarographically studied. By means of single sweep oscillographic polarography, the electrode reaction was demonstrated to be reversible and to involve the charge transfer of the 1-electron only. The diffusion coefficients of the halide ions dissolved in the electrolyte were measured in the temperature range 230-270 C. Thy Ox-species of the halide are soluble in the metal phase rather than in the electrolytic one, and are capable of exchange chemical reactions with the nitrate of the solvent giving rise to its decomposition. This exchange reaction is greatly affected by nitrogen oxides and consequently by the solvent preparation procedure and salt purification. The nitrogen oxides result in an inhibiting influence of the occurrence and/or extent of the exchange reaction as well as the capability of deforming halide waves. This explains the difficulties encountered in conventional polarography in avoiding maxima. The quantitative detection of the halides in molten nitrates is a very sensitive analytical tool as quantities lower than a few ppm are easily measured. (Author abstract modified)

435 APTIC NUMBER 16956

Frederick, D. S., H. D. Cogan, and C. S. Marvel
THE REACTION BETWEEN SULFUR DIOXIDE AND OLEFINS. CYCLOHEXENE. J. Am. Chem. Soc., vol. 56:1815-1819, Aug. 1934. 24 refs.

The polymeric sulfone obtained by the addition of sulfur dioxide to cyclohexene was described. The addition reaction does not take place readily if the hydrocarbon is carefully free from all traces of oxygen-containing compounds. The reaction can be catalyzed by the introduction of a small amount of 2% aqueous hydrogen peroxide. The presence of a trace of an alcohol in the reaction mixture seems to improve the yield slightly and also to improve the color and stability of the addition product. The reactants combine at room temperature to yield a white amorphous substance which is insoluble in most organic solvents. The product often becomes discolored on standing; this is more marked when all extra moisture is removed by careful drying. Aqueous alkalies have little effect on the product in the cold. However, hot alkalies break up the polymer, yielding cyclohexene, cyclohexenylsulfinic or sulfonic acid, octahydrodiphenyl, dicylcohexenylsulfone, dodecahydrophenoxthine dioxide, potassium sulfite, and other unidentified compounds. The formation of these products by alkaline decomposition of the addition compound give experimental substantiation to the polysulfone structure. The presence of one hydroxyl group in the polymer was fixed by treating with chloroacetyl chloride to give a monochloroacetyl derivative. The presence of a hydroxyl group was further substantiated by acetylation. The acetylated polymer is more stable toward heat, drying, and discoloration in the air than is the original polymer.

436 APTIC NUMBER 16030

Frey, Frederick E. and Robert D. Snow
PROCESS FOR PRODUCING RESINOUS REACTION PRODUCTS. (Phillips Petroleum Co., Bartlesville, Okla.) U. S. Pat. 2,112, 986. 3p., April 5, 1938. (Appl. July 23, 1935, 12 claims).

A process for the production of resinous products with improved molding characteristics and mechanical properties was invented. High molecular weight heteropolymeric products were produced by reacting sulfur dioxide with a mixture of two or more aliphatic olefins. The aliphatic olefins have a carbon content of 3-6 carbon atoms per molecule. They differ from each other in molecular weight and the number of carbon atoms per molecule. The relative proportion of the olefin to the mixture is enough to improve and modify the physical properties of the compound compared to a compound of sulfur dioxide and only one olefin.

437 APTIC NUMBER 17301

Gal'tsev, A. P. and V. N. Osipov
DETERMINATION OF THE ABSORPTION FUNCTION FOR THE 9.6 AND 4.7 MICRON OZONE BANDS, WITH CONSIDERATION OF THEIR FINE STRUCTURE. Bull. Acad. Sci. USSR, Phys. Atmos. Oceans (English translation from Russian of: Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana), 5(9):514-520, Sept. 1969. 17 refs. (Presented at the VII All-Union Conference on Actinometry and Atmospheric Optics, May 27-31, 1968 and at the Fifth International Symposium on Radiation, Aug. 22-30, 1968.)

The complex character of the oscillatory-rotational spectrum of the ozone molecule is a source of difficulty in attempts to obtain the radiation transmission function from band models. Of the models allowing for the fine structure of ozone bands, the familiar quasistatistical model which occupies a position midway between conventional and direct methods of calculating transmission functions is complicated to use. Moreover, it does not give the analytical relationship of the function to the parameters on which it depends. A modified statistical method is suggested which takes into account the real distribution of spectral line intensity. The intensity and position of the rotational lines in the 4.7 micron ozone band are calculated. The transmission function is determined, and its constituent parameters permitting the calculation of radiation transmission for the reciprocal cm intervals of the 9.6 and 4.7 micron ozone bands are given. The theoretical calculations are in satisfactory agreement with available experimental results. (Author abstract modified)

438 APTIC NUMBER 12419

Gay, B. W. and J. J. Bufalini
NITRIC ACID: FORMATION BY PHOTOOXIDATION OF HYDROCARBONS IN THE

PRESENCE OF OXIDES OF NITROGEN. Preprint, National Air Pollution Control Administration, Cincinnati, Ohio, Div. of Chemistry and Physics, 4p., 1969. 5 refs.

Ethylene was photooxidized in the presence of nitrogen dioxide under static conditions. Light intensity was measured by NO2 photolysis. Colorimetric analyses were made for NO2 initially and throughout the irradiations with the modified Griess regeant. Nitric acid was also analyzed colorimetrically by the reduction diazotization method. Ethylene, carbon monoxide, were monitored by a gas chromatograph. Nitrogen was analyzed by vapor-phase chromatography on a molecular sieve column with a helium photoionization detector. After several experiments it became obvious that molecular nitrogen was not formed. When 21 ppm ethylene was irradiated for 5 hrs with 3.75 ppm NO2, 25.6 ppm carbon was reacted. The products observed were 10.24 ppm CO; 3.9 ppm CO2; 10.7 ppm CH2O; and 0.3 ppm methyl nitrate. The total carbon observed was then 25.14 ppm. This value represents an excellent carbon balance and indicates that nitrogen cannot coexist with carbon to form a compound. Analyses were than made for nitric acid in the gas phase; none was detected. The inner surface of the flask was washed with 200 ml of 0.1N sodium hydroxide, and an aliquot was used CO determine nitrate by reduction diazotization. This analysis yielded a nitrate concentration of 3.46 ppm. The total nitrogen was 100% accounted for as nitrates. Experiments were extended with the irradiation of 1,3-butadiene. Carbon balance was not good. Nitrogen balance was excellent, with most of the nitrogen again appearing on the walls of the reaction vessel. Although no complete mechanism was suggested, a reaction particularly attractive was N2O5 + H2O(wall) yields 2HNO3 (wall).

439 APTIC NUMBER 15654

Gelb, E. J. and S. W. Steen
DIELECTRIC PERCENTAGE SATURATION DETECTOR. Anal. Chem., 41(7):990-991, June 1969. 3 refs.

A relatively inexpensive adiabatic percent saturation detector was constructed by using the physical property of the dielectric constant of water vapor and its proportionality to capacitance change in an air condenser. A simple circuit was designed and the reference cell of the detector filled with the gases to be normalized at their existing temperature and pressure. Upon changing the water vapor concentration in the sensing condenser, correlation of the percentage humidity was determined. The detector was separated from the electronic circuit and could be placed in a process stream at temperatures up to 300 C and pressure up to 100 psi gauge. The detector exhibited a linear dynamic range of 0.5 to 90.0% humidity. A response time of less than one second was recorded for the drift-free amplifier unit. The analysis is nondestructive and the detector is independent of changes in temperature and flow of the stream. The dector is capable of many common industrial saturation analyses, such as solvent recovery in extraction processes.

440 APTIC NUMBER 16038

Gerlovin, Ya. I.
THE PROBABILITIES OF SPONTANEOUS RADIATION CORRESPONDING TO THE VIBRATIONAL-ROTATIONAL BANDS OF AMMONIA, ACETYLENE, AND SULFUR DIOXIDE. Opt. Spectry. (USSR) (English translation from Russian of: Opt. i Spektroskopiya), 23(6):535-537, Dec. 1967. 6 refs.

Rotational-vibrational bands of ammonia, acetylene, and sulfur dioxide were investigated by a method permitting the determination of the probability of spontaneous radiation corresponding to the bands. The reduction of the radiation current passing from a receiver to a heat sink when a radiating gas is in its path depends on the intensity of the absorption band. This method has several advantages over methods based on measurements of the absolute intensity of the bands. The sensitivity of the method used was increased by employing a heat sink consisting of a glass flask and cooling device. Calculated probabilities of radiation correspond to ammonia bands in the regions 6.15 and 10.3 micron; acetylene bands in the regions 7.5 and 13.7 micron; and sulfur dioxide bands in the regions 4.0, 7.3, 8.7, and 19.3 micron. Comparison of the probability values of the three gases shows that the deviation between them is small.

441 APTIC NUMBER 17134

Gilliland, E. R., R. F. Baddour, and P. L. T. Brian
GAS ABSORPTION ACCOMPANIED BY A LIQUID-PHASE CHEMICAL REACTION. Am. Inst. Chem. Engrs. J., 4(2):223-230, June 1958. 14 refs.

The rate of absorption of chlorine from chlorine-nitrogen mixtures into solutions of ferrous chloride in 0.203 N aqueous hydrochloric acid was studied in a short wetted-wall column. Dimensional analysis and the film and penetration theories were used to infer, from the absorption rate data, that the chemical reaction between chlorine and the ferrous ion is second order. The absorption-rate results for experiments with a dilute gas phase agreed with theoretical predictions for absorption accompanied by a second order reaction with a reaction rate constant of 188 liters/(g mole)(sec). The results for experiments with pure chlorine gas deviated from the rest of the results, and they did not agree with the theoretical equations. It was shown that the assumption of a three-step mechanism for the chemical reaction, including the formation of a complex ion and the decomposition of this complex ion, explains, at least qualitatively, the deviations observed for the pure chlorine gas runs. (Author abstract modified)

442 APTIC NUMBER 17008

Glazyrin, M. P. and A. A. Fotiyev
OPTICAL STUDY OF COMPOUNDS FORMED IN THE SYSTEM K2O-V2O5. (Opticheskoye issledovaniye soyedinenii, obrazuyushchikhsya v sisteme K2O-V2O5). Text in Russian. Kristallografiya, 9(4): 506-510, 1964. 9 refs.

Microscopic phase analysis of the K2O-V2O5 system and detailed investigations of the optical properties and crystal structure of compounds of this system were made. Six phases with different optical properties were detected, and the chemical compositions of these phases were studied. Compounds with the following K2O:V2O5 molar ratios were studied and their optical characteristics determined - 1:4, 2:5, 1:1, 16:9, 2:1, 3:1.

Phase analysis revealed the occurrence of four potassium vanadates in the range of greater than 50 molar % K2O: KVO3, K32V18061, K4V2O7, K3VO4. In the range of less than 50 molar % K2O, compounds with K2O:V2O5 had starting ratios of 1:4 and 2:5. Compositions with K2O:V2O5 starting ratios of 1:2, 2:9, 1:3, 3:1, and 4:1 are not individual chemical compounds but represent eutectic mixtures.

443 APTIC NUMBER 16913

Good, A. and J. C. J. Thynne
REACTION OF FREE RADICALS WITH SULPHUR DIOXIDE. PART I. METHYL RADICALS. Trans. Faraday Soc., 63(11):2708-2714, 1967. 26 refs.

The reaction of SO2 with methyl radicals, generated from the photolysis of azomethane at lambda greater than 3400 A, was studied from 25-164 C. At low temperatures, the addition reaction to form methylsulfonyl radicals is fast; as the temperature increases, the radicals become increasingly unstable. They appear not to be formed at 164 C. Arrhenius parameters were measured or deduced by a material balance method for the following reactions: CH3 + CH3N2CH3 yields CH4 + CH2N2CH3; CH3 + SO2 yields CH3SO2; and CH3SO2 yields CH3 + SO2. A value of 0.04 was obtained for the disproportionation:combination ratio of methyl and methylsulfonyl radicals. The addition reaction of methyl radicals with SO2 is compared with their reaction with oxygen, carbon monoxide, and ethylene. Although the reaction with oxygen requires zero activation energy, the three-body limitation for the oxygen reaction leads to the conclusion that in the gas phase, the overall addition rates of methyl radicals to SO2 and O2 are similar at 50 mm Hg. Because of this similarity, sulfur dioxide-oxygen reactions with hydrocarbon radicals tend to form RSO2, not RO2, radicals as the initial addition step when sulfur concentrations are great. In reactions occurring in the atmosphere, it is expected that low SO2 concentration reactions with free radicals will occur rapidly. (Author abstract modified)

444 APTIC NUMBER 16675

Grimes, W. R., N. V. Smith, and G. M. Watson
SOLUBILITY OF NOBLE GASES IN MOLTEN FLUORIDES. I. IN MIXTURES OF NAF-ZRF4 (53-47 MOLE %) AND NAF-ZRF4-UF4 (50-46-4 MOLE %). J. Phys. Chem., vol. 62:862-866, 1958. 17 refs.

Solubilities of He, Ne, A, and Xe were determined at 0.5 to 2 atm in NaF-ZrF4 (53-47 mole%) at 600, 700, and 800 deg. The solubilities increase linearly with gas pressure, decrease with increasing atomic weight of the solute, and increase with increasing temperatures. Henry's law constants in moles of solute (cu cm solution) (atm) at 600 deg are 21.6 plus or minus 0.001; 11.3 plus or minus 0.3 times 10 to the eighth power; 5.06 plus or minus 0.15 times 10 to the eighth power; and 1.94 plus or minus 0.2 times 10 to the eighth power, while heats of solution are 6.2, 7.8, 8.2, and 11.1 kcal/mole for He, Ne, A, and Xe, respectively. Solubilities and heats of solution for He and Xe in NaF-ZrF4-UF4 (50-46-4 mole%) are very similar to the values obtained with these gases in the NaF-ZrF4 mixture. (Author abstract modified)

445 APTIC NUMBER 16757

Gross, Paul, Robert T. P. deTreville, and Martin M. Haller
PULMONARY FERRUGINOUS BODIES IN CITY DWELLERS. Arch. Environ. Health, 19(2):186-188, Aug. 1969. 9 refs.

Chrysotile, which comprises more than 90% of the asbestos used in this country, has a characteristic electron diffraction pattern because of its unique, hollow, tubular, crystalline structure, as seen under the electron microscope. On the basis of the electron diffraction pattern, chrysotile was decisively excluded as a constituent of the cores of all 28 ferruginous bodies isolated from lungs of urban dwellers not occupationally exposed to asbestos. This exclusion is considered highly significant because if the ferruginous bodies in the above city dwellers had been caused by the inhalation of asbestos dust, then some of the cores should logically be composed of chrysotile. (Author's Abstract)

446 APTIC NUMBER 17208

Guenther, Klaus F.
SURFACE ACTIVITY IN FUSED POTASSIUM NITRATE-LITHIUM NITRATE EUTECTIC. J. Phys. Chem., 67(12):2851-2853, Dec. 1963. 11 refs.

An investigation to study the behavior of some organic solutes in fused salts, with emphasis on the surface tension-concentration relationship, is described. The solvent used was the potassium nitrate-lithium nitrate eutectic; the first members of the homologous series of the sodium alkylates, sodium perfluoro-alkylates, and alkyl ammonium halogenides were used as solutes. Surface tension was determined by the maximum bubble pressure method. The surface pressure-bulk concentration relationship can be expressed by a Szyszkowski-type formula. The reproducibility of the measured surface pressure values was plus or minus 0.5% and the calculated values were within 0.5% of the experimental values. The nearly quantitative agreement of the area occupied by the adsorbed ions at high concentrations in the fused eutectic, determined by using the simplified form of the Gibbs adsorption isotherm and by using other methods in aqueous solutions, shows that this equation is applicable to fused salt systems.

447 APTIC NUMBER 17155

Haagen-Smit, A. J. and M. M. Fox
OZONE FORMATION IN PHOTOCHEMICAL OXIDATION OF ORGANIC SUBSTANCES. Ind. Eng. Chem., 48(9):1484-1487, Sept. 1956. 9 refs.

Ozone formation observed in polluted air was duplicated in the laboratory. An oxygen atmosphere adjusted to 30% humidity and an irradiation time of 10 hours were selected as standards in the experimental procedure. The ozone formed was measured by the cracking observed on the bent rubber strips suspended in 5-liter flasks during irradiation. When 2-butene in concentrations of 3 ppm and nitrogen dioxide in concentrations varying from 0-20 ppm are irradiated, cracks appear at a concentration approximating

0.2-0.4 ppm nitrogen dioxide. Cracking increases until a maximum is reached at a nitrogen dioxide concentration of 2-3 ppm. After passing this maximum, the rubber cracking diminishes and at about 20 ppm nitrogen dioxide, only a few cracks appear during the 10-hour irradiation. The average rate of ozone formation during the first 10 hours of irradiation of 3-methylheptane (3 ppm) and nitrogen dioxide (1 ppm) is about 0.8 ppm/hour. The general shape of the curves obtained in the experiments was attributed to at least two simultaneous reactions: the formation of ozone; and the removal of ozone by both nitrogen dioxide and the oxidation products of the hydrocarbon. At a concentration of 3 ppm and varying concentrations of nitrogen dioxide, the hydrocarbons, n-butane, n-pentane, n-hexane, n-heptane, and di-isobutylene gave similar curves to the one obtained with 3-methylheptane, with optimum ozone formation at from 1-3 ppm nitrogen dioxide. Ozone formation is also shown by the oxidation products of hydrocarbons such as acids, aldehydes, ketones, and alcohols. The results showed that ozone formation is proportional to the product of the hydrocarbon and nitrogen oxide concentrations. The present control measures are directed mainly toward reduction of hydrocarbon, while nitrogen oxides from high temperature combustion sources continue to increase. This increase in nitrogen oxides demands greater efficiency in hydrocarbon recovery. Since the reduction of hydrocarbon emission will only be partial, it is essential to study the other component of the smog-forming system, nitrogen oxides, and to institute engineering research necessary for the reduction of nitrogen oxides released by combustion processes.

448 APTIC NUMBER 17173

Halstead, C. J. and D. R. Jenkins
SULPHUR-DIOXIDE-CATALYZED RECOMBINATION OF RADICALS IN PREMIXED FUEL-RICH HYDROGEN + OXYGEN + NITROGEN FLAMES. Trans. Faraday Soc., 65(563):3013-3022, Nov. 1969. 12 refs.

The rate of recombination of hydrogen atoms was measured in a group of hydrogen + oxygen + nitrogen flames at 2000 K containing up to 1% volume sulfur dioxide. The catalysis of the rate of recombination by sulfur dioxide was confirmed; at 2000 K, it is second order with respect to the hydrogen atom concentration. The rate of catalysis followed the reaction scheme: (1) H + SO2 + M in equilibrium with HSO2 + M (equilibrium constant K3); (2) HSO2 + H yields H2 + SO2 (rate constant k4); and (3) HSO2 + OH yields H2O + SO2 (rate constant k5). The rate determining steps were reactions 2 and 3. Values for K3k4 and K3k5 were derived which, with an estimate of K3, gave k4 approximately equal to 5 times 10 to the minus 12th and k5 less than 8 times 10 to the minus 12th ml/molecule sec. Calculations for the effect of temperature on the overall rate of reactions showed that the order of the reaction with respect to the hydrogen atom concentration changed to first order at lower temperatures. (Author abstract modified)

449 APTIC NUMBER 17125

Hannick, Dalziel Llewellyn
THE ACTION OF SULPHUR DIOXIDE ON METAL OXIDES. PART I. J. Chem. Soc., vol. 3:379-389, 1917. 9 refs.

The interaction of sulfur dioxide with the following oxides is reported: stannous, manganous, ferrous, lead (PbO), cupric, bismuth (Bi_2O_3), mercuric, and manganese dioxide. The experiments were performed by passing the gas directly from a siphon of the liquid oxide over specimens of the various metal oxides heated in porcelain boats inside a silica tube. The reactions which occurred in each series of tests are described, and probable reaction mechanisms are suggested.

450 APTIC NUMBER 17223

Hampson, R. F., Jr. and H. Okabe
COLLISIONAL STIMULATION OF THE O(1S)-O(1D) EMISSION OF OXYGEN ATOMS FORMED IN VACUUM-ULTRAVIOLET PHOTOLYSIS OF NITROUS OXIDE. J. Chem. Phys., 52(4):1930-1933, Feb. 15, 1970. 17 refs.

Oxygen atoms in the 1S state were produced by the vacuum-ultraviolet photolysis of nitrous oxide and observed by their emission at 5577 A in the 1S-1D transition. The stimulation of this emission by collision with added gases was studied. The emission was proportional to the pressure of the added gas. Xenon was the most efficient stimulator, followed in order of decreasing efficiency by Kr, Ar, N2, H2, and He. Data obtained by photolysis of NO2 and CO2 was used to estimate their quantum yields for the formation of O(1S). (Author abstract modified)

451 APTIC NUMBER 17123

Hardy, C. J. and R. O. Field
THE VOLATILITY OF NITRATES AND NITRITES OF THE ALKALI METALS. J. Chem. Soc., 1963:5130-5134, Nov.-Dec. 1963. 21 refs.

Nitrates of alkali metals and nitrates of sodium and potassium were distilled without significant decomposition (except for lithium nitrate trihydrate) at approximately 0.005 and from 350-500 deg. The volatility of these salts is compared with both that of the covalent nitrato-complexes of various metals and with that of the alkali-metal halides which are considered to exist as ion pairs in the vapor state. Possible practical applications of the distillation of the salts are discussed. Purification by distillation may be particularly useful where crystals or films of the salts are required to be of high purity with respect to heavy metals or nonvolatile trace elements. The method will also enable thin films of large surface areas to be prepared and a study to be made of the crystal growth of nitrates and nitrites from the vapor phase on to a variety of substrates for comparison with oriented crystal growth from solution. (Author abstract modified)

452 APTIC NUMBER 16954

Hill, Arthur E. and Thomas B. Fitzgerald
THE COMPOUNDS OF SULFUR DIOXIDE WITH VARIOUS AMINES. J. Am. Chem. Soc., vol. 57:250-254, Feb. 1935. 6 refs.

A series of aromatic and aliphatic amines were treated with measured volumes of sulfur dioxide at constant temperature, and the

vapor pressures were measured. By means of pressure-composition diagrams, the composition of the compounds which formed was deduced. With toluidines, the existence of compounds in the 1:1 ratio was indicated. The solid compounds were yellow and the residual solution assumed an orange tint. The results with quinoline indicated the formation of a 1:1 compound which was yellow in color. Experiments with piperidine and with pyridine gave no solid compounds, but with pyridine, there was marked absorption of gas and the formation of the typical orange-red solution. The o-phenylenediamine reacted with sulfur dioxide in a 1:2 and a 1:1 ratio, giving red solids not distinguishable by the eye, but with clearly distinguishable pressures. The p-phenylenediamine also gave a red solid compound, but in a ratio of 2:1. Benzidine, treated with the sulfur dioxide, gave a 2:1 compound, but was a yellow color not resembling the p-phenlenediamine analog. Comparison of these compounds failed to indicate any simple relationship between the number of sulfur dioxide groups and the number of amino or phenyl groups. With the four homologs of aniline, no solid phase was obtained. With lower aliphatic amines, quantitative results were not obtained, as was previously reported. With the amyl and heptyl amines, the 1/2:1 compounds were white, and the 1:1 compounds were yellow, resembling those of the aromatic series. With normal amylamine, there was evidence of a metastable white compound showing the high pressure of about 175 mm, and presumably of the 1/2:1 ratio. A stable yellow compound was obtained at 7.6 mm. The vapor pressures of six of the addition compounds were measured at several temperatures and the heats of formation were calculated. It was not possible to correlate the heats of formation or the vapor pressures of the compounds to their structures.

453 APTIC NUMBER 16940

Holmes, Harry N. and A. L. Elder
VANADIUM COMPOUNDS AS CATALYSTS FOR THE OXIDATION OF SULFUR DIOXIDE. Ind. Eng. Chem., 22(5):471-473, May 1930. 19 refs.

Twelve different catalysts were prepared in an attempt to distribute vanadium compounds more evenly throughout the catalytic mass. The efficiency of the catalysts was also studied, as was the possibility of simultaneously producing a precipitate containing both the catalyst and the support. An example of the procedure used was the addition of potassium metavanadate to a solution of ferric chloride in equivalent quantities with the formation of a precipitate. The addition of excess ferric chloride causes the precipitate first formed to be peptized or colloidally dispersed. If this solution is then added to water glass, a single precipitate containing catalyst, promoter, and support is obtained. The final precipitation is due to the reaction between the acid of hydrolysis of the excess ferric chloride solution with the silicate solution and to the coagulating effect of the ferric ions. Catalyst efficiency was measured by determining the sulfur dioxide content of the gases entering and leaving the catalytic chamber by means of the Reich iodine test. The best catalyst obtained was made by mixing potassium metavanadate with an excess of calcium chloride to peptize the precipitate first formed and then neutralizing the excess calcium chloride with sodium silicate. This gel converted 98% of the sulfur dioxide to sulfur trioxide without any decrease in efficiency even after 60 hours of use when catalyzing 8% mixtures. Catalysts in which calcium was replaced with ferric iron were also very good. Copper, cobalt, nickel, chromium, and aluminum were not effective promoters. Mixtures of vanadium pentoxide, potassium hydroxide, Celite, and water glass also made an effective catalyst. Tungsten was not as efficient as vanadium. Carnolite was a poor catalyst. If vanadium catalysts have as long a life as platinum catalysts and resist poisons effectively, the process should have wide application.

454 APTIC NUMBER 17114

Homann, K. H. and H. G. Wagner
CHEMISTRY OF CARBON FORMATION IN FLAMES. Proc. Roy. Soc. (London), Ser. A, 307(1489):141-152, Oct. 1968. 31 refs.

Research on two types of carbon-forming flames is reviewed: (1) the acetylene type flame, where carbon appears above the whole flame cone; and (2) other types of flames which show carbon formation at the tip of the flame cone, either close to the flame front or a short distance above. Examples are given to show that transport processes, especially the back diffusion of hydrogen from parts of the burning zone with high curvature, have a strong influence on the process of carbon formation. Generally speaking, the local burning situation is important for carbon formation and this strongly depends on the flow patterns of the system in which the flame burns. The hydrocarbon species present in the reaction zone of the acetylene flame include the polycyclic aromatic hydrocarbons. The beginning of carbon formation is definitely related to the burning zone, where the oxidation process gives rise to various types of radicals in rather high concentrations. Carbon particles, acetylene, polyacetylenes, polycyclic aromatic molecules, water, and carbon dioxide are present in the burnt gases, but the formation of new particles or additional soot is apparently a very slow process. The activity of the 'older' carbon particles with respect to chemical reaction has been very much reduced, compared to that of 'young' particles. Various radicals are present in the oxidation zone, the reactions of which can easily give rise to the formation of hydrocarbons containing more C-atoms than the fuel molecule. The main reaction mechanism of C2H2 with O-atoms is given.

455 APTIC NUMBER 16961

Hunt, Madison and C. S. Marvel
THE REACTION BETWEEN SULFUR DIOXIDE AND OLEFINS. II. PROPYLENE. J. Am. Chem. Soc., vol. 57:1691-1696, Sept. 1935. 10 refs.

Sulfur dioxide and propylene combine to give a product $(C_3H_6SO_2)_n$ which differs markedly in physical and chemical properties from the polysulfone obtained from cyclohexene and sulfur dioxide. The propylene derivative is insoluble in all organic solvents and soluble in dilute aqueous alkalies; it is easily decomposed by the alkalies to yield simple products. Hydrolysis of the derivative, polypropylenesulfone, with alkali furnished conclusive evidence that its structure contains two types of sulfone linkages, one between secondary alkyl groups; the next, between primary alkyl groups, and so on alternately throughout the chain. When the polymer was dissolved in normal alkali and the cold alkaline solution was slowly acidified, $C_6H_{12}S_2O_4$ precipitated in almost

quantitave yields. This product was cleaved to yield carbon units. Treatment of the polysulfone with hot 5% sodium carbonate solution produced in small yield another six-carbon unit, C6H12SO3, which was the cyclic sulfone ether. Boiling a solution of the polysulfone in 10% aqueous sodium hydroxide produced no propylene and only traces of sodium sulfite, but hydrolyzed polypropylensulfone gave two products in excellent yields: a resin whose quantity suggested that two out of every six carbon atoms in the polysulfone are converted to acetaldehyde during hydrolysis, and a water insoluble salt with the composition C4H9S2O4Na. Sulfonyl chloride was prepared by oxidizing the latter compound and treating the oxidation product with melted pentachloride. The sulfonyl chorine in turn reacts with aniline to produce an anilide.

456 APTIC NUMBER 17063

Huygen, C.
REACTION OF NITROGEN DIOXIDE WITH GRIESS TYPE REAGENTS. Anal. Chem., 42(3):407-409, March 1970. 13 refs.

The absorption of nitrogen was studied, and the equivalence NO2(-):NO2 was determined by drawing air containing NO2 through absorbers filled with water or Griess type reagents and comparing the color intensities with those obtained with standard nitrite solutions. The absorption efficiency of water was minimal; that of N(1-naphthyl) ethylenediamine dihydrochloride (NEDA) was about 40%. Even higher efficiencies were observed for N,N(1-naphthyl, acetyl) ethylenediamine toluenemonosulfonate (ANEDA) and 1,8-diaminonaphthaline. Though all reagent components influenced the absorption efficiency to a certain extent, they apparently do not react directly with nitrogen dioxide. Therefore, it is assumed that nitrogen dioxide is absorbed in Griess type reagents mainly or wholly by reaction with the amine. The infrared spectrum of the yellow substance formed by NEDA or the other amines was compatible with the assumption that N-(4-nitro-1-napthyl) ethylenediamine was obtained. A corresponding compound formed from dimethylaniline was positively identified as p-nitrodimethylaniline. The results support the hypothesis that the absorption of NO2 proceeds by a radical formation. It is suggested that acidic solutions of aromatic amines may be used as selective filters to retain NO2 but not SO2.

457 APTIC NUMBER 16929

Ipatieff, V. N. and G. S. Monroe
DETERMINATION OF SOLUBILITIES OF GASES AT HIGH TEMPERATURES AND HIGH PRESSURES BY THE ROTATING BOMB. Ind. Eng. Chem., 14(2): 166-171, Feb. 15, 1942. 4 refs. (Presented at the Division of Petroleum Chemistry, 102nd Meeting of the American Chemical Society, Atlantic City, N. J.)

The modified rotating bomb was successfully used to determine the solubility of gases at high pressures and high temperatures approaching the critical point. The method applied to the determination of the solubility of methane in benzene indicates that pressure is the principal factor affecting the solubility. The effect of temperature is minor, becoming more noticeable at higher pressures. The solubility determinations of propane in benzene indicate that both temperature and pressure have a marked influence on the solubility. Solubility determinations of sulfur dioxide in benzene at room temperature showed that solubility increased noticeably with increasing pressure.

458 APTIC NUMBER 16679

Isbell, R. E., E. W. Wilson, Jr., and D. F. Smith
CRYOSCOPIC BEHAVIOR OF SELECTED SOLUTES IN THE MOLTEN ALKALI NITRATES. I. MOLTEN LITHIUM NITRATE. J. Phys. Chem., 70(8): 2493-2499, Aug. 1966. 13 refs.

Freezing point measurements were taken on dilute solutions of LiF, KNO3, NaNO3, Na2SO4, Li2SO4, KCl, CaSO4, NaCl, and LiCl in molten lithium nitrate as a solvent. Many of these solutions exhibit ideal behavior, as evidenced by the excellent agreement of the experimentally obtained freezing point constant for lithium nitrate with that obtained using the reported heat of fusion for lithium nitrate. Thermodynamic stability constants were determined in lithium nitrate and lithium nitrate-sodium sulfate or sodium chloride mixtures for CdSO4, PbSO4, CuSO4, CoCl2, CoSO4, and CdF2. The copper sulfate-lithium nitrate and cadmium sulfate-lithium nitrate systems may contain complexes of the type Cu(SO4)2(2-) and Cd(SO4)2(2-). The cadmium fluoride-lithium nitrate system did not appear to have any complexes formed in the concentration range 0.0-0.14 m. (Author abstract modified)

459 APTIC NUMBER 17040

Ishida, Takanobu and William Spindel
CHEMICAL AND ISOTOPIC EQUILIBRIA INVOLVING LIQUID AND GASEOUS NITROGEN OXIDES. J. Chem. Eng. Data, 15(1):107-144, Jan. 1970. 18 refs.

Existing experimental data dealing with liquid-gas-phase equilibria among nitrogen oxides (NO, NO2, and N2O4) were re-examined, and an improved method was developed for calculating the gas-phase composition for a given liquid phase and temperature. The method was used to calculate chemical compositions in such systems over a wide range of temperature and total pressure. The effective single-stage separation factor for concentrating nitrogen-15 by this exchange system was also evaluated over a broad range of operating conditions. The effective separation factor for any gas-liquid system is increased by the addition of nitric oxide to the system, as long as the added nitric oxide affects the vapor phase more than the liquid phase. As the composition of the vapor phase approaches that of pure nitric oxide, a point is reached where further increases in the relative amount of 2(+) nitrogen in the system affects the gas phase composition less than the composition of the liquid phase. (Author abstract modified)

460 APTIC NUMBER 17249

Isono, Ryukichi
EFFECTIVE CHIMNEY DESIGN FOR ATMOSPHERIC DIFFUSION. (Taiki kakusan ni kokateki na entotsu no sekkei ni tsuite). Text in Japanese. Nenryo Oyobi Nensyo (Fuel and Combustion),

36(8):729-741, Aug. 1, 1969. 3 refs.

As a result of the rapid development of industry in Japan, a large quantity of fuel, particularly heavy oil, is consumed. Harmful elements of smoke, sulfur oxides and other pollutants which arise from the combustion of these fuels are released into the atmosphere. This is causing serious social problems in various districts. The reason the exhaust gas is still released into air, in spite of the social problems is that this is the only practical way of dealing with the exhaust. For a chimney to be effective, the exhaust speed should be high enough to prevent down washing; a ratio of 1.5 to 1 is required in relation to the wind speed. Ideally, the effective inside diameter should be the same at the top and bottom of the chimney. A cap for the chimney should be avoided because it reduces exhaust speed. A large-scale chimney is preferred because of its efficiency and also the reliability of the structure and construction technique. Heat loss should be minimized to retain buoyancy of the plume. The number of chimneys in a plant should be minimized. It was concluded that corrosion of the chimney should also be considered in the chimney design.

461 APTIC NUMBER 16803

Jarman, R. T. and C. H. deTurville
THE VISIBILITY AND LENGTH OF CHIMNEY PLUMES. Atmos. Environ., 3(3):257-280, May 1969. 26 refs.

Monhebel's (1960) theoretical analysis of chimney smoke visibility is extended to incorporate the scattering of sunlight and skylight by plume particles. Relations are derived theoretically which show how both the visible length and the smoke contrast depend on the particles in the plume and the weather conditions. The theory treats inert particles which do not change by chemical reactions in the atmosphere or coagulation, etc. It is also limited to low particle concentrations where multiple scattering effects may be ignored. The accuracy of the calculation of the visibility and length of plumes from commercial power stations is limited because the optical properties of the smoke particles are not known accurately. However, using approximations for the optical properties of the complex smoke particles, given by the Mie theory for uniform spheres, it was found that there was reasonable agreement between the observed and calculated plume lengths and contrasts. It is known that in stable atmospheric conditions some plumes occasionally remain visible for some miles downwind of the chimney. These persistent plumes are discussed briefly and simple criteria for their occurrence are derived. (Author's Abstract)

462 APTIC NUMBER 17010

Johnston, Harold S. and Kapil Dev Jain
SULFUR DIOXIDE SENSITIZED PHOTOCHEMICAL OXIDATION OF HYDROCARBONS. Science, vol. 131:1523-1524, May 20, 1960. 4 refs.

In a study of fog formation, flasks filled with sulfur dioxide, n-butane, and air were either exposed to sunlight for two min to three weeks or kept in the dark for up to six months. Liquid products that formed in the flasks were analyzed by gas chromatographic and spectroscopic techniques. Light fogs formed in the presence of sulfur dioxide and butane or sulfur dioxide and air, but heavy fogs formed only when sulfur dioxide, n-butane, and air were simultaneously present. No fogs formed in mixtures kept in the dark. The liquid which settled out was colorless (butane and sulfur dioxide) or light yellow (air) but turned dark brown when exposed to sunlight. Experimental analysis of mixed liquid products gave an average empirical formula of $C_2H_5SO_5$. Spot tests for organic peroxides were negative. The mixed products are apparently highly oxidized, sulfur-containing, organic strong acids. It is proposed that the slow, cumulative photoreactions of sulfur dioxide with organic material adds up to a significant contribution to air pollution.

463 APTIC NUMBER 16939

Johnstone, H. F.
RECOVERY OF SULFUR DIOXIDE FROM WASTE GASES: EQUILIBRIUM PARTIAL VAPOR PRESSURES OVER SOLUTIONS OF THE AMMONIA-SULFUR DIOXIDE-WATER SYSTEM. Ind. Eng. Chem., 27(5):587-593, May 1935. 11 refs.

Equilibrium partial vapor pressures were measured at 35, 50, 70, and 90 C over a wide range of ammonia concentration and relative concentrations of sulfur dioxide in solutions of the ammonia-sulfur dioxide-water system. The formula for partial pressure for the concentrations in the cyclic process of absorption of sulfur dioxide from waste gases and regeneration by distillation are given. The partial pressure of water follows Raoult's law. Graph data show that the capacity of the solution is increased by lowering the temperature of regeneration or the temperature of absorption. The vapor pressure of sulfur dioxide over the regenerated solution at 35 C decreases as the concentration of ammonia decreases or as the temperature of regeneration is reduced. For more complete removal of sulfur dioxide from the waste gases, either dilute solutions must be used or regeneration accomplished under a vacuum. Dilute solutions also give a more favorable shape for the absorption curve: the rate of absorption is greatest in dilute solutions. The maximum loss of ammonia to the gases being scrubbed, due to vaporization from the regenerated solutions, amounts to only 1.8 pounds per million cu ft of gas when the solution, regenerated at 90 C, enters the solution at 35 C. This estimate is bases on a concentrated solution containing 22.5 moles of ammonia per 100 moles of water. The capacity of ammonia-sulfur dioxide-water systems for absorbing sulfur dioxide from 0.3% of gases can be as high as 8 pounds per 100 pounds of solution.

464 APTIC NUMBER 16671

Jordan, Joseph, R. A. Javick, and W. E. Ranz
HYDRODYNAMIC VOLTAMMETRY AT SOLID INDICATOR ELECTRODES. J. Am. Chem. Soc., vol. 80:3846-3852, Aug. 5, 1958. 19 refs. (Presented at the Eighth Pittsburgh Conference of Analytical Chemistry and Applied Spectroscopy, March 1957.)

A circulatory electrolysis cell assembly with controlled hydrodynamic characteristics was devised for the study at stationary solid indicator electrodes of current-voltage curves in flowing solutions. A new microconical platinum electrode is described and the relevant theoretical limiting current equation is derived. Most experiments were carried out in a 0.1 M solution of potassium chloride, saturated with air. In a range of flow

velocities between 25 and 500 cm/sec, oxygen, ferricyanide and aquo-ferric ion at the conical platinum microelectrode yielded sigmoid current-voltage waves with well-defined limiting currents. Implications are discussed to quantitative voltammetric analysis in flowing media. Oscilloscopic evidence is presented that the random fluctuations of the limiting currents, normally observed at the rotated platinum wire electrode, are due to turbulence. A constant limiting current, free of transient fluctuations, was obtained in a purely laminar gravitational flow using a 'wall-less' electrolysis cell. The conical platinum microelectrode under suitable experimental conditions approximates the behavior of an electroanalytical flowmeter. Selected applications are considered as examples of an unorthodox approach to the measurement by electrochemical kinetics of rates of physical phenomena. (Author abstract modified)

465 APTIC NUMBER 16669

Jordan, Joseph
SIGNIFICANCE OF RATES AND EQUILIBRIA IN ELECTROANALYTICAL CHEMISTRY. Anal. Chem., 27(11):1708-1711, Nov. 1955. 16 refs.

On the basis of Nernstian equilibria and kinetics, reversibility and irreversibility of simple electrode reactions are interpreted in term of two competing rate processes - viz, mass transfer and electron transfer. The corresponding relationships are illustrated by experiments of hydrodynamic voltammetry where current-voltage curves are determined in solutions which are allowed to stream with varying flow velocities past a stationary indicator electrode. By adjusting the rate of flow, the shape of the current-voltage wave of ferricyanide can be changed from reversible to irreversible over an appreciable range of potentials. A generalized wave equation is derived for current voltage curves obtained by hydrodynamic voltammetry, which can be used for the determination of the rate of electron transfer. Because the latter is a monotonic exponential function of the potential, control by mass transfer prevails whenever a true limiting current is attained, irrespective of the apparent reversibility or irreversibility of the ascending portion of the wave. Since the rate of diffusive and/or convective transport is in all known instances proportional to the bulk concentration of the electroactive species, limiting currents of this type may always be applied with confidence to quantitative analysis. (Author abstract modified)

466 APTIC NUMBER 17211

Julien, Edmond and Maurice Contat
KINETICS OF THE ANODIC OXIDATION OF NITROUS ACID AND OF NITRITE IONS ON A PLATINUM ELECTRODE. (Cinetique de l'oxydation anodique de l'acide nitreux et des ions nitrite sur electrode de platine). Text in French. Rev. Chim. Minerale, 6(5):885-900, 1969. 18 refs.

The value corresponding to the pK of the dissociation of nitrous acid enables one to distinguish in the potentiometric tests two domains of variation of the electrode potential E in mV: when pH is lower than pK, E equals 0.864 - 0.059 pH - 0.0295 log(HNO2); when pH is higher than pK, E equals 0.965 - 0.059 pH. The following net reactions were studied: HNO2 + H2O equals NO3(-) + 3H(+) + 2e; and NO2(-) + H2O equals NO3(-) + 2H(+) + 2e, which take place in several stages. Among several possibilities, two are consistent with the results of the study: formation of N2O3 in a rapid chemical reaction preceding the transfer of electric charge; and formation of the neutral HNO3 during the transfer stage which then rapidly dissociates in the stage following the electric-charge transfer. Potentiostatic, potentiodynamic, and galvanometric measurements of the system on the Pt electrode have shown that its kinetics are limited by the diffusion of the reacting species to the electrode and that there is a chemical reaction preceding the electric-charge transfer. The observations are complicated by the appearance of superficial oxide film, the kinetics of formation of which interferes with the kinetics of oxidation of HNO2, or of the nitrite ion, and which produces a passivation phenomenon to boot. A reaction scheme which accounts for both this passivation and the orders of reactions with respect to the various species involved could be the following: HNO2(Sol.) equals HNO2(el.); HNO2 + Pt yields PtHNO2; Pt + H2O yields PtOH + H(+) + e; PtHNO2 + PtOH yields PtHNO3 + PtH; PtHNO3 yields H(+) + NO3(-1) + Pt; PtH yields Pt + H(+) + e. This scheme does not exhibit the intermediate stage which can be inferred from the results of potentiometric measurements. Yet, this is what one should expect if one assumes that the superficial oxides film can not form unless there is polarization of the electrode. The passivation phenomenon encountered in the present study is in need of a thorough investigation, particularly from the point of view of superposition of the processes of diffusion and adsorption.

467 APTIC NUMBER 17319

Karn, F.S., R. A. Friedel, and A. G. Sharkey, Jr.
GASES FROM LASER PYROLYSIS OF ORGANIC MATERIALS. Chem. Ind. (London), no. 7:239-240, Feb. 14, 1970. 6 refs.

Laser irradiation of coal, petroleum, and rubber produced simple gas mixtures in contrast to the complex mixtures resulting from conventional slow pyrolysis of organic compounds. Gases from all three materials were quite similar for irradiations in helium atmospheres, consisting predominantly of hydrogen and acetylene. With coal, carbon monoxide and carbon dioxide are also major products. The above materials represent some of the most difficult waste disposal products. The results point out the advantage of higher pyrolysis temperatures. At temperatures in excess of 1000 C, the product is simplified and therefore more easily marketed. The gases are also more valuable since acetylene has approximately 10 times the market value of other hydrocarbon products.

468 APTIC NUMBER 17169

Kato, Akio, Yorinobu Goto, Sanae Kawazoe, Shinji Wada, and Tetsuro Seiyama
A KINETIC STUDY OF SULFUR DIOXIDE OXIDATION ON VANADIUM PENTOXIDE. (Sanka banajiumu (V) ni yoru nisanka iou sanka hanno no sokudoronteki kenkyu). Text in Japanese. Nippon Kagaku Zasshi (J. Chem. Soc. Japan), 90(12):1212-1218, 1969. 14 refs.

The mechanism of sulfur dioxide oxidation on a vanadium oxide

catalyst was determined. The reaction rate was measured on a pure V205 catalyst by varying the temperature and partial pressure of the reactants. The surface structure of the catalyst under reaction conditions was also investigated by measuring the electrical conductivity and electron diffraction of the evaporated V205 film. The conductivity measurements and electron diffraction of the V205 film showed that in SO2 air mixtures at temperatures from 450-550 C, the surface of the V205 catalyst is in a reduced state which has a composition between V205 and V6013. The oxidation and reduction of the catalyst steadily takes place on its surface. Experimental initial rates of SO2 oxidation on the V205 catalyst at temperatures from 394 to 554 C also agreed well with the rate expressions derived by an application of steady state treatment to the oxidation and reduction processes of the catalyst. It was concluded that SO2 oxidation on V205 proceeds by the steady repetition of the differential oxidation and reduction of the catalyst at an oxidation level between V205 and V6013. The activation energies for the oxidation and reduction of the catalyst were 26 and 18 kcal/mole respectively. (Author abstract modified)

469 APTIC NUMBER 17060

Keulks, George W. and A. Ravi
INFRARED SPECTROSCOPIC STUDY OF CARBON MONOXIDE ADSORPTION ON HYDROGEN AND OXYGEN TREATED SILVER SURFACES. J. Phys. Chem., 74(4):783-786, Feb. 19, 1970. 16 refs.

The adsorption of carbon monoxide on silica- and alumina-supported silver samples pre-treated with hydrogen and oxygen was studied by infrared spectroscopic techniques. The spectra of the silica-supported samples pre-treated with hydrogen at 150-175 deg showed no new bands, but the alumina-supported samples exhibited bands at 1230, 1430, and approximately 1650 reciprocal cm. No room temperature adsorption was observed on the samples pre-treated at 150 deg with hydrogen. When silica-supported samples were pre-treated with oxygen at 150 deg, the only new band observed when carbon monoxide was introduced was the 2180 reciprocal cm band. With the alumina-supported samples, the 2180 reciprocal cm band was observed and also the bands observed earlier with the hydrogen-pre-treated samples. The 2180 reciprocal cm band is attributed to the weak, reversible chemisorption of carbon monoxide on surface oxygen ions. No evidence was found for the room temperature chemisorption of carbon monoxide on bare silver metal.

470 APTIC NUMBER 16677

Kikuchi, Ryoichi
THEORY OF ONE-DIMENSIONAL FLUID BINARY MIXTURES. J. Chem. Phys., 23(12):2327-2332, Dec. 1955. 10 refs.

A rigorous equation of state is derived for a one-dimensional system of particles obeying classical statistics, with arbitrary inter-particle potentials. The solution, which assumes that a particle interacts with its nearest neighbors, provides the interpretation of parameters used in the lattice model of binary mixtures. It is possible that the method will be applicable to the solid-liquid transition in three-dimensional systems.

471 APTIC NUMBER 15832

Kirkland, J. J.
QUANTITATIVE APPLICATION OF POTASSIUM BROMIDE DISK TECHNIQUE IN INFRARED SPECTROSCOPY. Anal. Chem., 27(10):1537-1541, Oct. 1955. 8 refs.

In a study of the potassium bromide disk technique for the quantitative infrared spectrophotometric analysis of solids, several procedures for dispersing solids in potassium bromide were compared. The methods were ball milling the sample with KBr, grinding the material in a mortar with powdered KBr, and grinding the substance with KBr in a mechanical vibrator-grinder with the help of small steel balls. The vibrator-grinder technique was found to be especially advantageous for preparing of sample mixtures from difficultly ground materials. This procedure is rapid, requires no elaborate equipment, and is generally applicable to a wide variety of substances not soluble in useful infrared solvents. The reproducibility of the various methods of sample preparation was determined. The applicability of the disk method was tested with one- and two-component organic systems and several different crystalline forms of silica. The precision of the data obtained by the disk method compares favorably with conventional liquid-phase measurements. Although the techniques described were applied to only a limited number of quantitative studies, these experiments suggest the wide applicability of the disk method to the solution of complex analytical problems which in the past could not be studied by infrared spectrophotometric techniques because of solubility limitations. (Author abstract modified)

472 APTIC NUMBER 16944

Kiselev, A. V.
SURFACE CHEMISTRY, ADSORPTION ENERGY, AND ADSORPTION EQUILIBRIA. Quart. Rev. (London), vol. 15:99-124, 1961. 69 refs.

This review deals with several examples of the effect of the nature of adsorption systems (i.e., the surface chemistry and molecular structure of the adsorbate) on adsorption properties, mainly the adsorption energy but partly the adsorption equilibria. The current status of the problem of theoretically predicting the properties of adsorption systems is discussed and recent progress noted: use of adsorbents, primarily graphitized thermal carbon blacks, with sufficiently large and sufficiently homogeneous surfaces; development of a method of calculating the potential energy of adsorption of molecules on homogeneous crystal faces starting from information on only the structure and physical properties of the adsorbent and adsorbate; and advances in the statistical-thermodynamic treatment of adsorption equilibria. Adsorption heats are developed theoretically, including those of various non-polar substances, alcohols, and water on graphitized carbon blacks; of hydrocarbons on magnesium oxides and hydroxide; and of variously modified silicas. Various methods of calculating adsorption equilibria are worked out. It is concluded that the various methods each have value and should be developed in parallel. As progress in such theoretical treatment continues, it is expected that the absolute calculation of heats of adsorption and adsorption equilibria purely from the structure

and physical properties of the adsorbent and adsorbate will acquire greater importance, particularly in determining not so much what the adsorption properties of a given system are, but the reasons for their having such properties. (Author conclusions modified)

473 APTIC NUMBER 11822

Klug, W.
THE GOVERNING EQUATIONS OF TURBULENT MOTION IN A HORIZONTALLY HOMOGENEOUS SURFACE LAYER. In: Notes on the Theoretical Basis of the Equations for the Atmosphere's Surface Layer. Environmental Science Services Administration, Oak Ridge, Tenn., Inst. for Environmental Research, TN-1ERTN-ATDL-7, p. 12-16, Nov. 1967.

Starting with the equations of motion, continuity, and rates of change of energy as given by the Boussinesq approximation, equations governing the surface layer were derived. During the derivation, it was assumed that the surface layer is horizontally homogeneous. Each of the three variables of state, density, pressure, and temperature were divided into three terms: a term which gave the average of the quantity over the whole domain; a term which considered the height variation of the quantity during the absence of motion; and a term which took into account the turbulent fluctuations of the quantity concerned. Model assumptions for the atmospheric surface layer were as follows: stationarity of all quantities; horizontal mean flow; the coordinate system directed with its x axis in the direction of the mean flow; and horizontal homogeneity of the mean temperature field. Horizontal homogeneity of the turbulent fluxes and of the mean flow was also assumed.

474 APTIC NUMBER 17272

Kochubey, V. F. and F. B. Moin
KINETICS OF THE REACTION BETWEEN CO2 AND HYDROGEN. (Kinetika reaktsii CO2 s vodorodom). Text in Russian. Kinetika i Kataliz, 10(6):1203-1209, 1969. 16 refs.

The kinetics of carbon dioxide reaction with hydrogen to form water and carbon monoxide was studied. Reaction was carried out in a stream with thermodynamically balanced concentrations of hydrogen atoms at atmospheric pressure and temperatures of 750-1250 C. The rate of CO and H2O formation was determined gravimetrically. Rate constants for the forward and reverse reactions are as follows, respectively: 1.02 times 10 to the 14th power exp(-24200/RT), and 5.99 times 10 to the 11th power exp(-1220/RT) cu cm/mole/sec.

475 APTIC NUMBER 15889

Kohn, Robert E.
A MATHEMATICAL PROGRAMMING MODEL FOR AIR POLLUTION CONTROL. School Sci. Math., June 1969:487-494. (Presented at the Central Association of Science and Mathematics Teachers, Annual Convention, St Louis, Nov. 30, 1968.)

Mathematical models are proposed for computer processing to determine the least possible cost of pollution controls in an airshed. Advantages of the models are their simplicity, emphasis on economic efficiency, and appropriateness for the type of data normally available. One model considers a hypothetical airshed for a single industry, cement manufacturing. Annual production is 2,500,000 barrels of cement; two pounds of dust are emitted for every barrel produced. The least cost solution to the emission problem would be to install a four-field electrostatic precipitator on kilns producing 1,000,000 barrels and a five-field precipitator on kilns producing 1,500,000 barrels. A second model concerns the five major pollutants in the Saint Louis airshed in 1970: sulfur dioxide, carbon monoxide, hydrocarbons, nitrogen oxides, and particulates. Among the possible control methods included in the model are exhaust and crankcase devices for automobiles, the substitution of natural gas for coal, catalytic oxidation of sulfur dioxide to sulfuric acid at power plants, and the use of low sulfur-content coal. Pollution reduction requirements are itemized. The computer-derived solution of this model indicates the cost and efficiency of each reduction method. A third model evaluates the effects of air pollution on humans, vegetation, and materials. It can be used to determine whether the relative damaging effects of pollutants are proportional to their control cost.

476 APTIC NUMBER 15626

Krasnii, E. B., T. G. Musin, L. I. Piguzova, and E. N. Prokofjeva
ADSORPTION PROPERTIES OF HIGH-SILICEOUS ZEOLITE AS REGARDS NITROGEN OXIDES. (Adsorbtsionnyye svoystva vysokokremnezemnykh tseolitov po otnosheniyu k okislam azota). Text in Russian. Khim. Prom. (Moscow), no. 9:41-43, 1969. 6 refs.

Studies were made of the acid resistance and adsorption properties of synthesized highly siliceous dealuminized mordenite with SiO2:Al2O3 ratios of 30:1, 19:1 and 13:1. The adsorption of NO2-N2O4 was carried out at 20 C with an NO2-N2O4 vapor pressure of 720.05 mm Hg. The adsorbent was pretreated by heating to 300 C at 0.00005 mm Hg. The saturation capacity of all specimens tested was 30 g/100 g, but for any given relative pressure, the maximum capacity of a given mordenite varied inversely with the SiO2:Al2O3 ratio. Desorption studies indicated lack of complete reversibility of the process, and combined use of this physical method with chemisorption is seen as a practical possibility for treatment of exhaust gases from nitric acid production for treatment of exhaust gases from nitric acid production when the concentration of nitrogen oxides does not exceed 1-2%, and for use with internal combustion engine exhaust.

477 APTIC NUMBER 17002

Kurin, N. P. and N. P. Figurovskaya
CONTACT PROPERTIES OF CHROMIUM OXIDE-STANNIC OXIDE CATALYSTS FOR OXIDATION OF SO2 TO SO3. (Issledovaniye kontaktnykh svoystv khromo-olovyannykh Katalizatorov dlya okisleniya SO2 v SO3). Text in Russian. Izv. Tomsk. Politekhn. Inst., vol. 83:210-239, 1956. 25 refs.

Thirteen chromium oxide and stannic oxide catalysts with 0 to 100 weight % SnO2 and 1.5 to 2.0 mm grain size were produced by simultaneous precipitation of Cr2O3 and SnO2 at 80 C by washing, filtering, drying, pressing, crushing and sifting, from solutions of Cr and Sn salts. A mixture of 7 volume % SO2, 11 % O2, and 82 % N2 passed at a pressure of 1 atm for 2 to 8 hours at different specific volume rates between 600 and 2500 through 5 cu cm of the catalyst placed at two consecutive lower bends in a double U-shaped glass tube immersed into a vigorously stirred molten mixture of 55% NaNO3 and 45% KNO3 maintained at different test temperatures between 350 and 550 C. In addition, a catalyst with 33.13 weight % SnO2 was used with different gas plus N2 mixtures containing: 7 volume % SO2, 0 % SO3 and 2 to 19 % O2; 2 to 14% SO2, 0% SO3 and 11% O2; 7% SO2, 1 to 10% SO3 and 11% O2, at a volume rate of 1000 and at different test temperatures between 400 and 500 C. The degree of oxidation of SO2 and SO3, determined by the iodometric method, under these test conditions is plotted as a function of the volume rate and test temperature for each composition of the catalyst and as a function of the test temperature and volume rate for each composition of the catalyst. as a function of the composition of the catalyst and the test temperature at the volume rate of 600; and as a function of the O2 content, of the SO2 content, and of the SO3 content of the gas + N2 mixture and of the test temperature. From these data the rate constant, K, of the reaction 2(SO2) + O2 yields 2(SO3) at the different test temperatures and at the different volume rates in the presence of each of the 13 tested Cr2O3 + SnO2 catalysts was computed with the aid of an expression obtained by integration of the relation: d(c(SO3))/dt equals K(c(SO2)-c(SO2)eq)/square root of c(SO3), after replacing time, t, by 1/(v(T(273))), where v is the specific volume rate, in 1/hr, and T, the absolute temperature, in K, and expressing the equilibrium concentration, c(SO2)eq, and the current concentrations, c(SO2) and c(SO3), in terms of the initial SO2 content of the SO2 + O2 + N2 mixture and of the equilibrium and current oxidation rates. The rectilinear plots of log K vs 1/T for each of the 13 catalysts abruptly change their slope at test temperatures between 400 and 425 C. The expression used for computation of the rate constant, K, in the case of the constant mixture with 7% SO2, 11% O2 and 82% N2 proved inadequate when mixtures with varying contents of SO2, O2, and SO3 were used. This fact led to the derivation of another, more general expression for K.

478 APTIC NUMBER 17003

Kurin, N. P. and N. T. Budyuk
THE ACTIVITY OF CHROMIUM OXIDE-STANNIC OXIDE CATALYST FOR THE OXIDATION OF SO2 TO SO3. (Issledovaniye aktivnosti Khromo-olovyannykh Katalizatorov dlya okisleniya SO2 v SO3). Text in Russian. Izv. Tomsk. Politekhn. Inst., vol. 83:163-174, 1956. 19 refs.

Twelve chromium oxide + stannic oxide catalysts with 0 to 100 weight % SnO2 and 1.5 to 2.0 mm grain size were produced by mechanical mixing, pressing, crushing, and sifting of commercial chemically pure Cr2O3 and specially prepared SnO2. A mixture of 7 volume % sulfur dioxide and air passed at a pressure of 1 atm for 2.5 to 3 hours at a specific volume rate of 1000 1/hr through 5 ml of the catalyst in a 5 mm thin walled U-shaped glass tube immersed into a vigorously stirred molten mixture of 55% NaNO3 and 45% KNO3 maintained at different test temperatures between 350 and 600 C. In addition, catalysts with 0.619 and 1.224 weight % SnO2 were used at different specific volume rates between 200 and 1200 1/hr at these temperatures. The degree of oxidation of SO2 to SO3, determined by the iodometric method, under these test conditions was plotted as a function of the test temperature and the composition of the catalyst and as a function of test temperature and specific volume rate. At the specific volume rate of 1000 1/hr, at test temperatures between 400 and 550 C, the degree of oxidiation vs SnO2 content curves has a narrow peak at 1.224 weight % SnO2, increases gradually to a higher maximum at 49.78 weight % SnO2, decreases very slightly until 79.8 weight of SnO2, and, then, drops more rapidly to the value of pure SnO2, thus clearly exhibiting the phenomenon of coactivation. As the test temperature increases, the degree of oxidation of SO2 by the less active Cr2O3 + SnO2 catalysts increases monotonically with it to the highest used, while that by the most active ones increases with it, attaining a maximum between 550 and 600 C, and then decreases slightly, following the equilibrium curve. At 0.619 and 1.224 weight % SnO2 and all test temperatures, the degree of oxidation decreases with increasing specific volume rate. From these data the rate constant, K, of the reaction 2(SO2) + O2 yields 2(SO3) at the different test temperatures in the presence of each of the 12 tested Cr2O3 + SnO2 catalysts was computed with the aid of an expression obtained by integration of the relation: d(c(SO3))/dt equals K(c(SO2)-c(SO2)eq)/square root of c(SO3), after replacing time, t, by 1/(v(T/273)), where v is the specific volume rate, in 1/hr, and T, the absolute temperature, in K, and expressing the equilibrium concentration, c(SO2)eq, and the current concentration, c(SO2) and c(SO3), in terms of the initial SO2 content of the SO2 + air mixture and of the equilibrium and current oxidation rates. The rectilinear plots of log K vs 1/T for each of the 12 catalysts shown abruptly change their slope at test temperatures between 400 and 500 C.

479 APTIC NUMBER 16665

Kust, R. N.
CARBONATE ION DISSOCIATION IN FUSED ALKALI NITRATES. Inorg. Chem., 3(7):1035-1036, July 1964. 7 refs.

The equilibrium constant K for the dissociation of carbonate ion in fused equimolar sodium-potassium nitrate solvent, according to the reversible reaction CO3(-2) yields CO2 plus O(-2), was determined potentiometrically with an oxygen-platinum indicator electrode in conjunction with a silver-silver nitrate (1.0 M AgNO3 in equimolar (Na,K)NO3) reference electrode. Values of K obtained were (3.9 plus or minus 0.5) times 10(-6) at 523 K and (5.6 plus or minus 0.2) times 10(-25) at 580 K. Delta H deg and Delta S deg for the dissociation were constant over the temperature range studied and were found to be 27.0 plus or minus 0.1 kcal and 27.1 plus or minus e. u., respectively. Values for Delta G deg at 523 and 573 deg K are 12.9 plus or minus 0.1 and 11.5 plus or minus 0.1 kcal, respectively. (Author abstract modified)

480 APTIC NUMBER 16920

Kuznetsova, A. S., L. M. Skrebkova, and B. S. Khristoforov
PHASE ANALYSIS OF IRON-MOLYBDENUM CATALYSTS. (Fazovyy analiz

zhelezomolibdenovykh katalizatorov). Text in Russian. Kinetika i Kataliz, 7(2):354-355, 1966. 5 refs.

In a search for a selective solvent of Fe2(MoO4)3 and for the optimal conditions of its extraction, the published methods of phase analysis of natural Mo compounds or of products originating during processing of Mo ores are inappropriate. Samples of Fe-Mo catalysts, MoO3, Fe2O3, artificial mixtures of these, and normal Fe2(MoO4)3 were subjected to the action of aqueous ammonia solutions, hydrochloric acid, and solutions of sodium citrate and hydrazine hydrochloride, at various concentrations and temperatures and for different durations. The following method of phase analysis of Fe-Mo catalysts with a Mo/Fe ratio greater than or equal to 1.5 was developed: 0.5 to 1.0 gram of the catalyst ground to 200 mesh is placed in a 250 to 300 ml beaker with a ground stopper and is thoroughly mixed in a 1/400 ratio with a 0.3 M freshly prepared hydrazine hydrochloride solution at room temperature for 1.5 hours. Under these conditions, Fe2(MoO4)3 goes into solution completely; free MoO3, only 14 to 16%; and Fe2O3 is practically insoluble. After freeing the solution of the solid residue by pouring it through a dense double filter into a 500 ml beaker, one rinses it 6 to 8 times with a 1% hydrazine hydrochloride solution and neutralizes the excess hydrazine hydrochloride by gradual additions of aqua regia to the boiling filtrate until its bright yellow color changes to dark green. Following this, the filtrate is boiled down to 80 to 100 ml, the Fe and Mo are separated by means of an alkali and their amounts are determined. Application of this method to Fe-Mo catalyst samples yielded results given in a table and two graphs showing that none of them is a simple mixture of Fe2O3 and MoO3. In samples with a Mo/Fe ratio close to 1.5 Fe2(MoO4)3 and in those with a Mo/Fe ratio less than 1, another Fe- and Mo-bearing compound is very likely to be present.

481 APTIC NUMBER 16963

Law, J.
ELECTRON SPIN RESONANCE STUDIES OF THE REACTIONS OF NITRIC OXIDE AND NITROGEN DIOXIDE WITH POLYMETHYL METHACRYLATE. Nature, no. 5056:1351-1354, Sept. 24, 1966. 8 refs.

The effect of nitric oxide and nitrogen dioxide on polymethyl methacrylate (PMMA) containing methyl methacrylate monomer (MMA) and on pure MMA was investigated with electron spin resonance (ESR) techniques. Samples of PMMA exposed continuously to nitrogen dioxide at 137 mm of mercury showed weak ESR signals with a few minutes. These signals decayed and disappeared within an hour. Samples exposed to a lower pressure of nitrogen dioxide showed larger signals that decayed more slowly. These signals showed no change in intensity when the nitrogen dioxide pressure was later increased. Samples of PMMA exposed to nitric oxide developed almost identical ESR spectra, although at high concentrations, nitric oxide radicals were stable for almost a week. Samples exposed alternately to nitric oxide at atm pressure for 48 hr and nitrogen dioxide at 137 mm of mercury lost their ESR signals; samples exposed to nitric oxide and nitrogen dioxide at 9 mm of mercury showed no change in signal intensity, indicating that each gas attacks the same site. A model for the kinetics of the nitrogen dioxide reaction gives good agreement with the experimental results.

482 APTIC NUMBER 17129

Lux, Hermann
REACTIONS IN THE MELT II. (Reaktionen in Schmelzfluss II). Text in German. Z. Elektrochem., 52(5):220-224, 1948. Part III-VI. Ibid, 52(5):224-226, 1948; 53(1):41-43, 1949; 53(1):43-45, 1949; 53(1):45-47, 1949. 16 refs.

The properties of various substances suited for the preparation of alkaline melts were studied in the molten eutectic Na2SO4-K2SO4 at 950 C and at concentrations ranging from 0.001-0.1 mol%. At the addition of Na2O or Na2O2, the potentials become negative. After some time, a slow linear decrease of the potential difference occurs due to evaporation of Na2O. At small concentrations, Na2CO3, Li2CO3, KNO3, NaNO2, and NaOH are converted quantitatively to alkali oxide. In part III, the increase of the O(-2) concentration at the dissolution of MgO in molten Na2SO4-K2SO4 eutectic was studied with the aid of potential measurements. The logarithm of the O(-2) concentration and thus the solubility of MgO depends linearly on the logarithm of the Mg(+2) concentration. In part IV, homogeneously dissolved NaPO4-Na3PO4 mixtures were studied at 950 C. A linear dependence of the measured potential difference or of the logarithm of the O(-2) concentration on the alkalinity was observed. In part V, the dissolution and dissociation of CaCO3 and CaO in Na2SO4-K2SO4-eutectic at 950 C was studied. The solubility of CaO in molten CaSO4 solutions of various concentrations was likewise studied. The solubility of CaO is 0.090 mol% if (Ca(+2)) equals (O(-2)). In part VI, the conversion of TiO2 and Na2O in molten alkali sulfate was studied. Upon addition of Na2TiO3 or Na2Ti2O5, an equilibrium is established between Na2TiO3 and Na2O. The last phase is Na2Ti3O7. The latter yields alkali oxide to TiO2 and it is assumed that Na2Ti5O11 is formed. At smaller O(-2) concentration, the solid phases Na2Ti5O11 and TiO2 are in equilibrium with each other.

483 APTIC NUMBER 17121

Meyer, Gilbert R. and George Thodos
VISCOSITY AND THERMAL CONDUCTIVITY OF SULFUR DIOXIDE IN THE GASEOUS AND LIQUID STATES. J. Chem. Eng. Data, 7(4):532-536, Oct. 1962. 37 refs.

Reduced state viscosity and thermal conductivity correlations were developed for sulfur dioxide. Values were obtained for viscosity at atmospheric pressure, thermal conductivites at atmospheric pressure, density for the superheated region and compressed liquid state of sulfur dioxide, residual viscosities in the dense gaseous region, and thermal conductivites for the dense gaseous and liquid regions. All measurements are presented graphically. The theoretical methods used in calculations are described in detail.

484 APTIC NUMBER 16029

Bhatt, Madhukar V.
SULFONATION OF CYCLOHEXYLAMINE WITH SO3. (Abbott Labs., North Chicago, Ill.) U. S. Pat. 3,226,430. 4p., Dec. 28, 1965. 10 refs.

(Appl. April 7, 1964, 9 claims).

An invention is described which provides a process for the manufacture of the amine salt, cyclohexylamine cyclohexylsulfamate, where the formation of sulfone and sulfate are suppressed. Amine salts are produced in high yields of exceptional purity. This process operates at 70 C, below the decomposition temperature of cyclohexylamine. Dry cyclohexylamine is reacted with dry sulfur trioxide in a zone of high turbulence to prevent overheating. The ratio of the reactants is selected in such a way that cyclohexylamine is present in at least a tenfold excess over the amount of sulfur trioxide when calculated on a molecular basis. Adequate turbulence is provided by mixing the reactants in an ejector, a venturi tube, a packed column, or similar equipment which would provide instantaneous mixing. The sulfur trioxide is preferably diluted with an inert gas such as nitrogen or dry air. The alkali and alkali earth salts of this acid are widely used as artificial sweetening agents.

485 APTIC NUMBER 17144

Morrey, John R. and Dan G. Carter
DENSITIES OF MOLTEN MIXTURES OF KCL AND ALCL3. J. Chem. Eng. Data, 13(1):94-96, Jan. 1968. 10 refs.

Densities of molten mixtures of KCl and AlCl3 were determined over a temperature range of 188.5-778.3 C and a compositional range of the mole fraction equal to 0-0.6666. Densities were determined by the use of quartz floats of differing densities. Temperature was accurately controlled by a precision temperature controller-magnetic amplifier-saturable reactor combination and was measured by a calibrated Pt-Pt-13% Rh thermocouple placed next to the sample and connected to a precision potentiometer. An empirical equation, density equals f(X,T) where T stands for temperature and X stands for mole fraction, was obtained from the data.

486 APTIC NUMBER 16696

Morton, Frank, P. J. King, and A. McLaughlin
HELICAL-COIL DISTILLATION COLUMNS PART I: EFFICIENCY STUDIES. Trans. Inst. Chem. Engrs. (London), 42(8):T285-T295, 1964. 26 refs.

Efficiency tests of four helical-coil distillation columns with tube diameters of 1.95, 1.1, 0.495, and 0.425 cm were carried out at atmospheric and reduced pressures with three test mixtures: chlorobenzene/ethyl benzene; n-heptane/methyl cyclo-hexane; and n-hexadecane/n-heptyl benzoate. At atmospheric pressures, the measured efficiencies of the columns were inversely proportional to tube diameter. When the experimental results were plotted in terms of height of transfer unit vs vapor Reynolds number, a single line was obtained which correlated the results for the four coils investigated. This indicates that the efficiencies of helical-coil columns at atmospheric pressures can also be correlated on the basis of negligible liquid-phase resistance. At reduced pressures, there was no direct relationship between height of the transfer unit and tube diameter, nor could experimental data be correlated only on the basis of vapor-phase resistance. This implies that liquid-phase resistance at reduced pressure is a significant portion of the total resistance. The increase in the liquid-phase resistance is attributed to higher viscosities and lower diffusivities encountered at reduced pressures. A comparison of the 1.1 cm diameter helical coil column with other high efficiency columns shows that at partial reflux and 20 mm Hg abs, the helical coil unit is particularly useful for low-pressure fractionation of heat-sensitive materials.

487 APTIC NUMBER 16982

Morton, Frank, P. J. King, and A. McLaughlin
HELICAL-COIL DISTILLATION COLUMNS. PART II. LIQUID FILM RESISTANCE. Trans. Inst. Chem. Engrs. (London), 42(8):T296-T304, 1964. 9 refs.

Liquid film resistance was studied using the technique of absorption of carbon dioxide from an atmosphere of pure gas. The relationship between hold-up values obtained experimentally in the coils and those predicted for the inclined tube was very similar to the relationship between the friction factors for coils and inclined tubes. A modified form of the Higbie equation was derived for the liquid film flowing down an inclined tube. This was used to correlate the liquid film mass transfer coefficients determined experimentally in helical coils. The experimental hold-up data and liquid film coefficients in helical coils were in general agreement with values predicted for the inclined tube. Application of these results to the distillation data indicated that reasonable values of the overall mass transfer coefficient were obtained only when calculated on the basis of substantial wetting of the whole surface of the tube. Evaluation of the thermal effects associated with this wetting phenomenon or differentiation between the possible mechanisms was not possible from the investigation. The flowrate of a liquid flowing down an inclined circular channel under laminar flow conditions was calculated in the appendix.

488 APTIC NUMBER 17228

Moskalenko, N. I.
EXPERIMENTAL INVESTIGATIONS OF THE SPECTRAL TRANSPARENCY OF H2O, CO2, CH4, N2O, and CO IN AN ARTIFICIAL ATMOSPHERE. Bull. Acad. Sci. USSR, Phys. Atmos. Oceans (English translation from Russian of: Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana), 5(9):552-555, Sept. 1969. 8 refs.

Spectral absorption in H2O vapor bands was measured for absorbing amounts from 0.1 to 12 cm of the precipitated layer, while absorption in nitrous oxide, carbon dioxide, methane, and carbon monoxide bands was measured for amounts up to 2000 atm cm. Absorption was studied at gas pressures from 0 to 4 atm in the infrared region 1-18 micron. The transmission spectra were obtained with an IKS-12 spectrometer and an optical attachment through which was constantly blown dried N2. Measurements of the transmission spectra were obtained relative to the windows, then transmission at the points of attachment was measured. By combining the spectra of relative transmission with transmission at the points of attachment, the spectra of absolute transmission was obtained. Some results of the spectral transmission measurements are illustrated in figures. The obtained spectra were used to explain the functional dependence of spectral

transmission on the absorbing mass and the effective pressure.

489 APTIC NUMBER 17168

Newton, Amos S. and A. F. Sciamanna
METASTABLE PEAKS IN THE MASS SPECTRA OF N2O AND NO2. II. J. Chem. Phys., 52(1):327-336, Jan. 1, 1970. 15 refs.

Metastable peaks rising from the delayed unimolecular dissociation of NO(+) to O(+) + N in the mass spectra of both nitrous oxide and nitrogen dioxide and from the dissociation of N2(+) and N(+) + N in the mass spectrum of N2O were investigated. A new metastable dissociation of N2O(2+) to NO(+) + N(+) was also studied. Further studies were made on the previously known metastable transitions of N2O(+) to NO(+) + N and of NO2(+) to NO(+) + O. The appearance potential, the kinetic-energy release in fragmentation, and the half-life were determined for each metastable transition. Comparisons were made of the energetic and half-life characteristics of the metastable NO(+) ion as produced from the sources NO, N2O, and NO2, and of the metastable N2(+) ion from the sources N2 and N2O. The results were consistent with the unimolecular dissociation of these diatomic ions, N2(+) and NO(+), proceeding by predissociation mechanisms. (Author abstract modified)

490 APTIC NUMBER 16674

Padova, J. and J. Soriano
DENSITIES OF NEODYMIUM NITRATE-MOLTEN ALKALI NITRATES AND LITHIUM PERCHLORATE MIXTURES. J. Chem. Eng. Data, 9(4):510, Oct. 1964. 3 refs.

The densities of mixtures of lithium perchlorate and NaNO3-KNO3 eutectic mixtures with or without neodymium nitrate was studied as a function of temperature. The data fitted the expression d equals a - bt, where d is the density; a and b are constants dependent upon the composition; and t is the temperature by a least squares analysis. As a part of a general study of lanthanide-nitrate interaction in molten media, the densities needed to calculate molar absorbance from spectrophotometric measurements were determined. The media used were the sodium-potassium nitrate eutectic with or without lithium perchlorate admixture. The densities were measured as a function of the concentration of neodymium nitrate and the temperature, over the range 230-400 C. (Author abstract modified)

491 APTIC NUMBER 16641

Paul, Ram Chand, S. C. Ahluwalia, and Sarvinder Singh Pahil
THERMOCHEMICAL STUDIES IN DIMETHYLFORMAMIDE: PART I. HEATS OF SOLUTION AND NEUTRALIZATION OF LEWIS ACIDS. Indian J. Chem., 3(7):300-304, 1965. 24 refs.

Thermochemical studies with an isothermal phase-change calorimeter were undertaken to determine the heats of solution and neutralization of various Lewis acids in the polar solvent dimethylformamide (DMF). The heats of solution of titanium (IV) bromide were between 51.52 and 52.59 kcal/mole, and those of tellurium (IV) bromide were between 21.0 and 26.5 kcal/mole. These values are higher than those of corresponding metal chlorides and indicate that bromides are better acceptors than chlorides. As determined from the heats of solution, the relative acceptor strength of the investigated acids in decreasing order is SO3, SbCl5, TiBr4, SnCl4, TiCl4, TeBr4, TeCl2, AsCl3, SbCl3, AlCl3, and CdCl2. Acid-base neutralization reactions involving the Lewis acids and alpha-picoline, dimethylaniline, quinoline, and pyridine bases suggest that the major enthalpy change in neutralization is the formation of dimethylformamide from the combination of H(+) and CON(Ch3)2(-) ions. Heats of solution in DMF indicate that the solvent enhances the strength of Lewis acids, having a higher solvating power than other solvents. The heats of neutralization confirm the enhanced acidic nature of the Lewis acids, with the obtained values suggesting that acid-base reaction in DMF involve the combination of solvoacids and solvobases.

492 APTIC NUMBER 16912

Pechkovskiy, V. V.
REGULARITIES OF FORMATION OF SULFIDES AND OXIDES OF METALS DURING THE THERMOCHEMICAL DECOMPOSITION OF SULFATES OF MANGANESE AND IRON. (Zakonomernosti obrazovaniya sul'fidov i okislov metallov pri termokhimicheskom razlozhenii sul'fatov margantsa i zheleza). Text in Russian. Zh. Prikl. Khim., 32(12):2613-2618, 1969. 9 refs.

The principal factors affecting the formation of sulfides and oxides during the process of reduction of metal sulfates were identified. Qualitative and quantitative studies of the compositions of the products of thermochemical dissociation of Fe- and Mn-sulfates were made at various reaction temperatures (in 50 deg steps), C-contents of the sulfate-carbon mixture, gas phase compositions, and additions of some metal oxides, and their dependence on some physico-chemical properties of substances participating in the reaction was determined. In addition, the reduction by C of Zn-, Mg- and Ca-sulfates was investigated. The degree of conversion of FeSO4 is presented, in %, at 450 to 750 C with 0 5 10, and 20% C mixtures and the degree of transition of sulfatic S into sulfidic S (as FeS and FeS2), in %; 1) at 750 to 900 C with 10, 20 and 30% C mixtures and 2) at 700 to 850 C with 10 and 20% C mixtures in the presence of some ZnO or Mn2O3. The degree of conversion and the degree of transition of sulfatic S into sulfidic S for MnSO4 is presented at 650 to 850 C with 13.8, 19.3 and 32.5% C mixtures as well as that degree of transition only at 700 to 900 C with a 24.2% C mixture in the presence of: no addition, argon with 7.5% SO2, or some CaO or Mn2O3. MgSO4, FeSO4, MnSO4, ZnSO4 and CaSO4 are presented with respect to the degree of transition of sulfatic S into sulfidic S at 700 to 950 C with a 28.0% C mixture. In the absence of C, the thermal dissociation of the metal-sulfates studied yields a solid phase formed largely of the oxide of the respective metal and a gas phase consisting of a mixture of SO2 and SO3. With C present in the mixture, the dissociation process occurs at lower reaction temperatures for given degrees of conversion of the metal surface. While with contents of less than 5 to 10% C in the mixture, the dissociation products remain practically the same as without C; with more than 10 to 15% C, metal sulfides are also formed, the metal sulfide/metal oxide

ratio in the solid phase increasing with the content of the mixture as well as with the reaction temperature. Thus, the roasting process of metal sulfates can be controlled by varying the operating conditions to yield one or another kind reaction product or any mixture of both.

493 APTIC NUMBER 16800

Penney, G. W.
SOME PROBLEMS IN THE APPLICATION OF THE DEUTSCH EQUATION TO INDUSTRIAL ELECTROSTATIC PRECIPITATION. J. Air Pollution Control Assoc., 19(8):596-600, Aug. 1969. 3 refs.

The variety of sizes and kinds of particles in industrial aerosols results in an efficiency curve which increases less rapidly with precipitator length than would be predicted by the Deutsch equation. In the two-stage precipitator used for cleaning ventilating air, the low degree of turbulence tends to give an efficiency increasing more rapidly with length than would be predicted by the Deutsch equation. When this effect is combined with the diversity of particles, it appears that a two-stage precipitator might give an efficiency curve approximating the Deutsch equation. However, in industrial precipitators the turbulence combined with the "electric wind" give a high degree of mixing so that the complete mixing assumed by Deutsch appears to be a reasonably good approximation. (Author's summary, modified)

494 APTIC NUMBER 17043

Petriconi, Gianna L. and Henry H. Papee
ON THE DECOMPOSITION OF AMMONIUM NITRATE IN THE ATMOSPHERE. J. Atmospheric Sci., 27(1):164-166, Jan. 1970. 28 refs.

The process by which ammonium salts are destroyed in the atmosphere, with ultimate conversion to oxygen, nitrogen and its oxides, and water, was studied in the laboratory with unfiltered light obtained from an immersion lamp. The effects of nitrate concentration, temperature, and radiation intensity were evaluated both by analysis for nitrite in irradiated solutions and by volumetric measurements of the gases evolved during irradiation and the dark decomposition. The overall effect of apparent nitrite formation was enhanced by increases in radiation intensity and inhibited by increases in nitrate concentration and temperature. The concurrent decomposition of nitrite and, hence, its dark decomposition, were enhanced by low pH values and high temperatures. The concurrent oxidation of the ammonium ion by transient species developed during nitrate photolysis led to a substantial increase in the acidity of the photolyzed solutions. Therefore, under suitable conditions, hygroscopic nitrous anhydride can be released from solutions. Since they are functions of temperature and radiation flux, it is concluded that the formation and photolysis of ammonium and ammonium nitrate are strongly dependent on the geographic location of a land mass.

495 APTIC NUMBER 16648

Pfeifer, Gyula
ABSORPTION OF SULFUR DIOXIDE IN DIMETHYL FORMAMIDE. (Ken-dioxid abszorpcioja dimetil-formamidban). Text in Hungarian. Magy. Kem. Folyoirat, 69(3):138-141, 1963. 5 refs.

The authors plotted absorption isotherms between 20 and 60 C on the basis of exact determinations of sulfur dioxide absorption in pure dimethyl formamide (DMF) and in 25%, 50% and 75% aqueous solutions of DMF. The dried DMF selected for investigation precipitated at 152 and 153 C under 750 torrs and had a density of 0.950 g/ml at 20 C. Data for calculations were obtained with a Smith-Menzies type 'isoteniscope'. Before absorption, the SO2 was washed by passing through a flask containing concentrated H2SO4. At 760 torrs partial pressure, the following SO2 solubilities in DMF were measured: at 20 C, 424 Nml; at 30 C, 313 Nml; at 40 C, 257 Nml; at 50 C, 205 Nml; at 60 C, 167 Nml.

496 APTIC NUMBER 17145

Piontelli, R., G. Sternheim, and M. Francini
OVERVOLTAGES AND PASSIVITY IN MELTED ELECTROLYTES. J. Chem. Phys., vol. 24:1113-1114, 1956. 6 refs.

Electrode overvoltages with melted electrolytes were investigated with electrodes at which a solid metal, whose electrochemical behavior in aqueous solutions is intermediate or inert, exchanges ions with a bath of fused chlorides. In the systems Ni/NiCl 10% to 20% + KCL 90% to 80% (by weight) and Cu/CuCl2 10% + KCl 90%, at 740 C, the apparent overvoltages presented pure ohmic character, as shown by the characteristics which are linear and symmetric both on the anodic and cathodic side; by the law of dependence of the apparent overvoltage on the effective thickness and conductivity of the bath layer included in the tensiometric cell; and by the form of the oscillographic recordings of the voltage output of the tensiometric cell, when the electrolysis cell is submitted to short rectangular pulses. The practical absence of exchange overvoltage appeared to be a general property at a high enough temperature and with melted chloride baths. The experiments also gave clear evidence of occurring anodic passivity phenomena with melted electrolytes, as a consequence of the presence or formation on the electrode surface of covering layers. The layers may consist of oxides or oxichlorides formed by spontaneous reaction or by anodic process when the baths are not carefully purified from the last traces of water; of oxides formed on the metal surface previous to the introduction of the metals in the cells; or of the chloride of the electrode metal, when in a multicomponents bath, an oversaturation condition with respect to this salt is attained at the electrode surface.

497 APTIC NUMBER 17136

Plummer, A. W.
THERMODYNAMIC DATA FOR SYSTEM SO2-H2O. BIBLIOGRAPHY AND CRITICAL ANALYSIS. Chem. Eng. Progr., 46(7):369-374, July 1950. 71 refs.

An exhaustive literature survey was made to locate equilibrium solubility-vapor pressure data for the system sulfur dioxide-water. (SO2-H2O). Data so obtained are statistically correlated

for SO2 concentrations of 0.03 to 10.0 g SO2/100g H2O and at temperatures of 0 to 130 C. The correlated results are presented as straight lines on an Othmer-Cox-type chart by modifying the ordinate. Slopes and intercepts are also presented at all SO2 concentrations for the linear equation log10 Pa equals b log10 pw + a relating the variables. Use of the Othmer method for this system is discussed. Heat effects calculated from the vapor-pressure curves are compared with those reported in the literature as independent determinations of heats of solution. The paucity of data above 130 C is demonstrated and suggestions made for further investigation in this region. A similarity of this system with seven other weak electrolytes is exhibited from changes in the first ionization constant with temperature. (Author abstract modified)

498 APTIC NUMBER 16983

Porter, K. E.
THE EFFECT OF CONTACT-TIME DISTRIBUTION ON GAS ABSORPTION WITH CHEMICAL REACTION. Trans. Inst. Chem. Engrs. (London), vol. 44: T25-T36, 1966. 26 refs.

A method is proposed to overcome thy problem of the unknown contact-time distribution in gas-liquid contacting equipment used for absorption with chemical reaction; the method is developed for absorption with irreversible second-order reaction. A form of correlation is devised in which the physico-chemical constants of the reaction and the hydrodynamics of the equipment (specified by the true contact-time distribution) are combined. The effect of the contact-time distribution on the rate of gas absorption with chemical reaction for one system may then in effect be estimated from test data on other reacting systems, obtained in the same equipment at the same gas and liquid flow-rates. The success of this method depends on similarity in the time dependence of absorption rate for different reactions. An active-inactive wetted-area model is developed to deal with the problem of stagnant pools in the packed column type of gas-liquid contacting equipment. It is concluded that the effect of a distribution of contact times in the region where pseudo-first-order absorption rates are being reduced by depletion of reactant is to cause the rate of absorption to be less than that predicted by the mean Higbie contact time. The extension of the method to other reacting systems is discussed; the problem of predicting the effect of a contact-time distribution on absorption with chemical reaction for many systems is considered similar to predicting its effect on absorption with second-order reactions, and in many cases, design based on the mean Higbie contact time will be sufficiently accurate.

499 APTIC NUMBER 16033

Prigmore, B. J. and B. E. Allen
ELECTRIC CAR TRACTION PARAMETERS. Automotive Design Eng., vol. 7:47-49, Dec. 1968. 6 refs.

Data on the potentialities of an electric traction for cars were reported. Experiments were based on six 12V 125 Ah lead-acid batteries and a 220 lb, 4 and one-half hp motor. The motor set-up of two series of field windings was altered to permanent weak field. The motor was mounted across the bonnet of the car, with a motor cycle chain drive to an extended cardan shaft. The car was made operational by mounting a carbon rheostat, a short-circuiting switch, and a main switch, on a board in front of the passenger. With this simple control equipment and a motor ammeter and voltmeter wired to the batteries, preliminary running was carried out. It was confirmed that permanent weak-field operation was satisfactory. Acceleration was adequate at 150 A, cruising at modest speeds required under 100 A, and short severe gradients were surmounted at under 200 A. Current/voltage/speed tests were performed by driving the car over a 100-ft timing section with about 300 feet of approach in which to accelerate. Constant voltage operation was obtained by connecting the batteries in parallel trios to give nominally 36V, and in pairs to give 24V. Speeds of 12.8 and 8.3 mph were attained. Preliminary tests curves were compared with the curve of predicted mechanical power requirements which were much greater than the experimental results. The discrepancy was due either to a gross underestimate of the total weight of the car, or neglect of a significant source of mechanical loss.

500 APTIC NUMBER 16996

Protsenko, P. I. and Z. I. Belova
BINARY SYSTEMS OF NITRATES OF METALS OF THE FIRST AND SECOND GROUPS WITH CALCIUM NITRATE. (Dvoynyye sistemy iz nitratov metallov pervoy i vtoroy grupp s nitratom kal'tsiya). Text in Russian. Zh. Neorgan. Khim., 2(11):2617-2620, 1957. 14 refs.

Binary systems of lithium, rubidium, cesium, thallium, strontium and barium nitrates with calcium nitrate; barium nitrate with strontium nitrate; and also diagonal sections of sodium nitrate with calcium nitrate and potassium with calcium nitrate were studied by the visual polythermal method. Results of this study support the rule that: if two components, A and B, form a eutectic or a solid solution, then the ordinate of composition of the eutectic or its minimum will be shifted in the direction of the component with the lowest melting point. This shift is greater, the greater the difference between the two melting points.

501 APTIC NUMBER 16911

Pupezin, Jovan, Slobodan Ribnikar, Zivojin Knezevic, and Vidosava Dokic
LIQUID-VAPOR EQUILIBRIUM AND THE THERMODYNAMIC PROPERTIES OF THE SYSTEM SULPHUR DIOXIDE + DIMETHYL ETHER. Bull. Boris Kidric Inst. Nucl. Sci., 17(4):297-309, Oct. 1966. 10 refs.

The liquid-vapor equilibrium of the Me2O + SO2 system was investigated, and the results used to calculate the excess thermodynamic functions. The system forms a negative azetrope of mole fraction 0.42 in Me2O at the normal boiling point of + 0.4 C. The excess free energy, enthalpy, and entropy in the whole concentration range are negative and almost symmetrical. Their values at -32.5 C in equimolar mixture are -0.457, -1.19, and -0.74 kcal/mol, respectively. The results indicate a strong interaction of the component molecules in both liquid and vapor phases that cannot be ascribed only to Van Der Waals forces. It

is possible that the molecules form an intermolecular complex by charge transfer. (Author abstract modified)

502 APTIC NUMBER 17012

Robb, W. L.
THIN SILICONE MEMBRANES - - THEIR PERMEATION PROPERTIES AND SOME APPLICATIONS. General Electric Co., Schenectady, N. Y., Research and Development Center, Rept. 65-C-031, 23p., Oct. 1965. 14 refs.

The rapid permeabilities of gases and vapors through silicone rubber, which result from the extremely high flexibility of the Si-O-Si chain, were examined as a function of pressure, temperature, silicone composition, and degree of cross-linking. Diffusion rates and solubility constants were also reported for gases in silicone rubber. The permeabilities measured showed no disagreement with previously published values. Diffusion rates in silicone rubber were almost an order of magnitude higher than the diffusion rates for the same gases in the most permeable hydrocarbon polymers. Direct measurements of gas solubilities in silicone materials with a sorption balance agreed reasonably well with the solubility values obtained indirectly by the time lag method. No change in permeation as a function of pressure was detected in the range 0.2-500 psi. Membrane thicknesses were varied from 0.1 ml to 30 ml and showed no effect. This indicated that gas absorption and desorption at the membrance surfaces offered negligible resistance compared with gas diffusion through the membrane; the situation persisted even for very thin membranes. Permeabilities were higher at low temperatures. Cross-linking had little effect on the motion of small segments of the silicone chain. Based on the ability to make 1-ml-thick, hole-free membranes, several applications for silicone films were examined. Results were reported on experiments demonstrating oxygen enrichment, breathing air regeneration, and utilization of the membranes as artificial gills.

503 APTIC NUMBER 16951

Ruthven, D. M. and C. W. Kenney
EQUILIBRIUM CHLORINE PRESSURES OVER CUPRIC CHLORIDE MELTS. J. Inorg. Nucl. Chem., 30(4):931-944, May 1968. 32 refs.

Equilibrium chlorine pressures were measured over halide melts containing cuprous and cupric chlorides. These include the liquid systems CuCl2-CuCl, CuCl2-CuCl-KCl, CuCl2-CuCl-KCl-LaCl3, and CuCl2-CuCl-ZnCl2. These data were used to obtain enthalpies and entropies of mixing; results showed that CuCl2-CuCl and CuCl2-CuCl-ZnCl2 are essentially ideal. The decrease in the entropy change which occurs when potassium chloride is added to the system CuCl2-CuCl is apparently due to an increase in the partial molar entropy of cupric chloride in the ternary system. This is a surprising effect, since quite large entropy differences are involved; this implies a significant change in melt structure. Spectroscopic evidence suggests the existence of complex cupric species in melts containing potassium chloride. The phase diagram for the system potassium chloride-cupric chloride shows definite evidence of compound formation and pronounced deviations from either an ideal or a regular solution. The evidence for the existence of complex cuprous species is less convincing, and there appears to be no evidence in support of the existence of diseric cuprous chloride species assumed by other investigators.

504 APTIC NUMBER 16921

Ryss, I. G. and L. P. Bogdanova
SYNTHESIS AND KINETICS OF THE HYDROLYSIS OF B-PICOLINESULFOTRIOXIDE. (Sintez i kinetika gidroliza B-pikolinsul'fotrioksida). Text in Russian. Zh. Neorgan. Khim., 12(8):2091-2093, 1967. 9 refs.

The progress of hydrohytic dissociation of B-picolinesulfotrioxide (B-Pic:SO3) at the temperatures of 0.50, 10.49, 20.12 and 29.98 C are determined by successive titrations of its aqueous solution with a 0.03 to 0.12 N solution of NaOH. The B-Pic:SO3 was prepared by adding drop by drop a solution of SO3 in 1,2-dichlorethane to an equal amount of a vigorously stirred ice-cooled solution of B-Pic in the same solvent. In a 'dry chamber', the resulting white precipitate of B-Pic:SO3 was filtered out, rinsed with 1,2-dichlorethane and chloroform and dried in a current of dry air. It contained 3.4% (B-Pic) HSO4. B-Pic:SO3 is colorless. Slightly more alkaline than pyridine (Py) and is rapidly wetted and solvated by alcohols. It is very hygroscopic owing to a rapid irreversible hydrolysis according to the formula: B-Pic:SO3 + H2O yields B-PicH(+) + HSO4(-). The test conditions and results are given in a table listing the temperature, t in C, the initial B-Pic:SO3 - concentration, in moles/liter, the number of titrations n, and duration in min of the test, as well as 0.4343k, where 0.4343 equals log(e) and k is the rate constant in 1/min. At all test temperatures, the share, X, of undissociated substance was found to vary with time, t, in min, according to the first - order reaction; log(Io/X) equals 0.4343kt, where Io is the value of X at t equals 0. The value of 0.4343k adopted at each test temperature was the arithmetic mean of the values obtained in several tests at that temperature. The dependence of the mean value of 0.4343k so determined on the absolute temperature, T, in K, is given by the equation: log(0.4343K) equals 11.3959 - 3994.9/T, whose coefficients were determined by the method of least squares. Using these coefficients, the activation energy and entropy were computed as E equals 18.25 Kcal and delta S equals -14.8 entropy units. Comparison of the present data with those previously obtained for Py:SO3 shows that the hydrolysis of B-Pic:SO3 proceeds approximately 4 times more slowly than that of Py:SO3 within the same temperature interval. This may be ascribed to a difference in the entropies of activation in the two cases.

505 APTIC NUMBER 16922

Schaafsma, A.
DISTRIBUTION OF SULFUR DIOXIDE IN A WATER-BENZENE SYSTEM. (De verdeeling van zwaveldioxyde over water en benzine). Text in Dutch. Chem. Weekblad, vol. 35:821-823, 1938.

The distribution of a low concentration of sulfur dioxide between water and benzene is governed by two equilibria: 1) the distribution equilibrium of SO2 molecules between the water and

the benzene, this being nearly a linear relationship for low concentrations; and 2) the dissociation equilibrium of the SO2 in water, which, in the case of a 0.1% content, does not involve any appreciable dissociation of HSO3 ions. The influence of the type of benzene used and the temperature on the distribution coefficient, which represents the ratio of the water concentration to the benzene concentration of SO2, is studied. The effect of the type of benzene is chiefly dependent upon its aromatic content, which can vary from 0% to 100%. For a benzene-water system with 0% aromatics, the SO2 seems to favor the water as a solvent, whereas if benzol (100% aromatic) is used, the SO2 favors the benzol. Volatility of the hydrocarbons plays a secondary role. Influence of temperature was studied by taking measurements at 0, 20, and 50 C. When a nonaromatic benzene was used, the distribution coefficient fell sharply with increases in temperature, whereas a benzol-water system gave a nearly constant value. Whereas the nonaromatic benzene-SO2 system represents a deviation from Raoult's law, this deviation grows smaller at higher temperatures and the degree of immiscibility tends to diminish. The deviation from Raoult's law also causes SO2 vapor pressure in the nonaromatic benzene to be higher than it would be in an ideal solution. At low temperatures, the nonaromatic-water system would have a relatively higher water-solubility of SO2. For the SO2-benzol-water system, the deviation from Raoult's law is somewhat smaller than for nonaromatic-water.

506 APTIC NUMBER 17206

Schenke, M., G. H. J. Broers, and J. A. A. Ketelaar
THE SOLUBILITY OF OXYGEN IN MOLTEN CARBONATES. Electrochem. Soc. J., vol. 113:404, 1966. 6 refs.

The solubility of oxygen in molten alkali carbonates with respect to galvanic high-temperature fuel cell research was determined. The method was based on an amperometric titration of dissolved oxygen, by adding stepwise solid Na2SO3 as a reducing agent. The oxygen was dissolved by leading an O2-CO2 gas mixture of known composition through the melt; titrations with Na2SO3 were carried out under a cover of a N2-CO2 mixture, while the CO2 partial pressure was kept constant. As an indicator, a system of two rotating platinum wire electrodes was used. During the experiment, a fixed potential difference was maintained between these electrodes potentiostatically, the current being a measure of the amount of dissolved oxygen. The solubility of oxygen was determined in the eutectic mixture of Li2CO3, Na2CO3, and K2CO3 and in the eutectic mixture Li2CO3 and Na2CO3. Henry's law was found to be obeyed within the limits of accuracy. There was a small, but certainly significant, dependence of solubility on the composition of the carbonate melt, both with respect to the absolute value and to the temperature coefficient. The solubilities of O2, as well as the heats of solution, were of the same order of magnitude for different melts and comparable with data found for other gases and other melts. The process of the solution was endothermic and the enthalpies of solution were calculated.

507 APTIC NUMBER 17226

Schoon, Nils-Herman and Leif Wannholt
EQUILIBRIUM DISTRIBUTION OF SULFUR DIOXIDE BETWEEN THE GAS PHASE AND AN AQUEOUS SOLUTION AT DIFFERENT IONIC STRENGTHS AND AT ELEVATED TEMPERATURES. Svensk Papperstid. (Stockholm), no. 2:28-31, Jan. 1970. 3 refs.

The equilibrium constant for the distribution of sulfur dioxide between the gas phase and an aqueous solution was calculated on the basis of pressure measurements made in an autoclave and on the acidity constant determined in a previous investigation. The equilibrium constant was calculated for ionic strengths of 0.5M-3M and for temperatures between 50 and 145 C. Measurements of the partial pressure of sulfur dioxide vs. the concentration of unprotolyzed sulfur dioxide in the liquid phase are given in the form of graphs. These figures show that the partial pressure increases proportionately with the concentration of SO2 and is also a function of the ionic strength. The equation log fits the experimental values well. (Author abstract modified)

508 APTIC NUMBER 17166

Schwab, Georg-Maria and Emmanuel Kaldis
THE ELECTRONIC MECHANISM OF THE CATALYTIC SO3 FORMATION. (Zum elektronischen Mechanismus der katalytischen SO3-Bildung). Text in German. Naturwissenschaften (Berlin), 50(15):516-517, 1963. 2 refs.

The speed of the reaction 2SO2 + O2 yields 2SO3 in O2 and 7% SO2 on Cr2O3 catalysts was determined by measuring the unoxidized SO2 fraction at various temperatures. From the temperature dependence of the reaction the activating energies were determined as follows: undoped Cr2O3, 31 kcal/mol; after doping with 1.7 mol% TiO2, 45 kcal/mol; after doping with 1.01 mol% NiO, 19 kcal/mol; and with 1.26 mol% Cu2O, 21 kcal/mol. All catalysts were preheated at 1400 C. Measurements of the thermoelectromotive force showed that electron conduction means negative thermoelectric force and hole conduction, positive thermoelectric force. At undoped Cr2O3 catalysts chemisorption of SO2 increases the negative thermoelectromotive force; at a Cr2O3 catalyst doped with 2.2 mol% NiO, the thermoelectromotive force is lower than at undoped catalyst, but likewise negative. The defect electron concentration is increased. With Cr2O3 doped with 0.11 mol% SnO2, no marked difference is observed in air over the undoped catalyst. The atmosphere of O2 with 7% SO2 reduces the negative thermo-e.m.f. below 650 C considerably and thus increases the p-conductivity. Through SO2, the tin dioxide was reduced to SnO, which is p-doped.

509 APTIC NUMBER 12373

Sehmel, G. A. and L. C. Schwendiman
PARTICLE DEPOSITION VELOCITIES AND PARTICLE CONCENTRATION PROFILES ABOVE THE DEPOSITION SURFACES. In: Pacific Northwest Laboratory Annual Report for 1967 to the USAEC Division of Biology and Medicine, vol. II. Physical Sciences, Part 3. Atmospheric Sciences. Battelle-Northwest, Richland, Wash., Pacific Northwest Lab., p. 103-108, Oct. 1968. 1 ref.
CFSTI: BNWL-715

The quantitative relationships among the variables governing particle deposition during turbulent flow of air in conduits were determined; deposition models were established, supported by data. Experimental data were obtained for the deposition of monodispersed uranine particles in verticle tubes of 1.152 in. ID. Data were simultaneously obtained for deposition velocities and radial concentration profiles of particles within the tubes. The results show that deposition in tubes is a function not of the average particle concentration, but of the concentration profile above the deposition surface. This type of profile could not be predicted from simple theories of deposition. Concentration profiles above deposition surfaces should be simultaneously measured with particle deposition to obtain data on which more adequate theories can be based.

510 APTIC NUMBER 12374

Sehmel, G. A., L. C. Schwendiman, and T. W. Horst
WIND TUNNEL FOR PARTICLE DEPOSITION MEASUREMENTS. In: Pacific Northwest Laboratory Annual Report for 1967 to the USEC Division of Biology and Medicine, vol. II. Physical Sciences, Part 3. Atmospheric Sciences. Battelle-Northwest, Richland, Wash., Pacific Northwest Lab., p. 101-103, Oct. 1968. 3 refs.
CFSTI: BNWL - 715

Recent experimental data have shown that particle concentration profiles in tubes are not always those predicted from diffusion theory. For deposition to dry surfaced tubes, the maximum concentration may be adjacent to the tube wall instead of at the tube center. So that the deposition behavior of particles can be studied on simulated larger scale surfaces in controlled laboratory equipment, a special wind tunnel was constructed. Air enters the tunnel through a 6 times 6 ft bank of high efficiency filters. Immediately downstream is a section for inserting screens and baffles for controlling air turbulence. The test aerosol is injected downstream of the screens. The tunnel is next contracted to a 2 times 2 ft cross section through a nozzle designed to reduce turbulence. The test section is a 30-ft length of the 2 time 2 ft cross section. Particle deposition will be studied for various test surfaces. Concurrent with deposition, air turbulence will be measured with a X-ray constant temperature anemometer system. The relating of deposition to turbulence is expected to permit better prediction of deposition in open terrain.

511 APTIC NUMBER 16978

Seyer, W. F. and W. F. Cornett
THE SYSTEM SULFUR DIOXIDE-DECALIN. Ind. Eng. Chem., 29(1):91-92, Jan. 1937. 2 refs.

The thermal data of the mixture decalin-sulfur dioxide was obtained. The bulb method was used for determining the freezing points and temperatures at which the two liquids disappeared. The critical solution temperature was 41.8 C. The shape of the freezing point curve indicates the presence of a ternary system and a difference in the solubility of the two forms of decalin. (Author abstract modified)

512 APTIC NUMBER 16659

Shams El Din, A. M. and A. A. El Hosary
POTENTIOMETRIC ACID-BASE TITRATIONS IN MOLTEN SALTS. THE ACID CHARACTER OF LI(+), NA(+), K(+), CA(2+), SR(2+), BA(2+) AND PB(2+) AS INFERRED FROM THE REACTION OF THEIR CARBONATES WITH K2CR2O7 IN MOLTEN KNO3. J. Electroanal. Chem., vol. 16:551-562, 1968. 10 refs.

The acid K2Cr2O7 was titrated potentiometrically with the carbonates of Li, Na, K, Ca, Sr, Ba, and Pb in fused KNO3 at 350 deg; both 'forward' neutralization experiments (in which the oxide-ion donors were added to the acid in fused KNO3) and 'backward' experiments (in which the procedure was reversed) were carried out. An oxygen electrode was used as indicator electrode and its potential was measured relative to an Ag/Ag(I), melt/glass reference half-cell. Both 'forward' and 'backward' neutralization curves (except for the case of Pb) consist of a single step corresponding usually to formation of CrO4(2-). 'Cyclic' neutralization curves with NaOH and KOH suggest that Na(+) is acid with respect to K(+). The acidity of Ca(2+), Sr(2+) and Ba(2+) decreases in the order given. CaCrO4 and SrCrO4 add an extra molecule of Na2CO3 to give CaCrO4.Na2CO3 (SrCrO4.Na2CO3); BaCrO4 does not. Pb(2+) is the most acid cation studied. PbCrO4 adds another molecule of PbCO3 and gives a second inflexion in the titration curves, corresponding to the formation of PbCrO4.PbCO3. PbCO3 decomposes thermally in fused KNO3 to give white lead, 2PbCO3.PbO. The reaction is zero-order with respect to PbCO3 and has an activation energy of 38.2 kcal mole(-1). The decreasing order of acidity established in these experiments is the same as that determined in a previous study on the basis of the reaction of the same carbonates with NaPO3. (Author summary modified)

513 APTIC NUMBER 17172

Sharma, H. D., R. E. Jervis, and K. Y. Wong
ISOTOPIC EXCHANGE REACTIONS IN NITROGEN OXIDES. J. Phys. Chem., 74(4):923-933, Feb. 19, 1970. 29 refs.

The kinetics of the oxygen self-exchange in the N(16)O(2) + N(18)O(2)2N(16)O(18)O reaction was studied in a fast-flow gas-phase tubular reactor in conjunction with a time-of-flight mass spectrometer. The reaction was second order and had a rate constant of 3.0 plus or minus 300,000 l reciprocal mol reciprocal sec at 25 deg. The rate constant had no measurable temperature dependence between 25 and 82 deg. The rate constant for oxygen atom exchange in N(14)O + N(15)O(2) in equilibrium with N2O3 reaction was 4.9 plus or minus 0.8 times 10 to the 7th power l reciprocal mol reciprocal sec at room temperature. The kinetics of exchange in the NO2-NO2 system indicates that a cyclic structure exists either in the transition state or as an intermediate. Similarly, there is a low possibility of bridge formation in the NO-NO2 system. Other exchange studies in the systems NO2-O(18)O(2) and NO-NO2(18-)O(2) indicate that the rapid self-exchange in the N(16)O(2)-N(18)O(2) and N(14)O-N(15)O(2) systems does not take place through any dissociative mechanism. (Author abstract modified)

514 APTIC NUMBER 16668

Shearer, R. E., J. C. King, and J. W. Mausteller
ELECTROCHEMICAL RECOVERY OF BREATHING OXYGEN FROM CARBON DIOXIDE. Aerospace Med., vol. 33:213-216, Feb. 1962. 5 refs. (Presented at the Aerospace Medical Association Meetings, Chicago, Ill., April 26, 1961.)

A closed-circuit respiratory system is described for converting one man's dioxide output to carbon and oxygen; the latter then provides most of the necessary oxygen for breathing, with the balance of the oxygen requirement obtained from the electrolysis of water condensed from the atmosphere. The system is based on the continuous electrolysis of molten lithium carbonate with simultaneous reaction of the lithium oxide product with CO2 fed to the cell; carbon is a by-product. The equations for these reactions are Li2CO3 yields Li2O plus C plus O2, and Li2O plus CO2 yields Li2CO3. CO2 is obtained from the atmosphere by adsorption and desorption from a molecular sieve bed. Electrolytes containing sodium or potassium salts are not as efficient as those with lithium salts; data is given suggesting that the very strongly reducing properties of metallic lithium are needed to prevent the production of large amounts of carbon oxides. The eutectic of the chloride and the carbonate of lithium melting at 506 C is the preferred composition for the system. Carbon, a product of the reactions at the cathode, builds up at that site, eventually resulting in an increase in carbon monoxide output, a signal to replace the cathode. Carbon can be chipped off and the electrode reinserted into the cell. A diagram of the carbonate electrolyzer is included.

515 APTIC NUMBER 17030

Shirai, Tsuneo, Yoshiaki Kudo, Masayuki Shimojo, and Saburo Yanagisawa
ION-MOLECULE REACTION OF HYDROCARBONS WITH NITROGEN MONOXIDE. (Tankasuiso to issankachisso no ion bunshi hanno). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 3(2):123-125, 1969. 3 refs.

Ion-molecule reactions between several hydrocarbons and nitric oxide were investigated in the ionization chamber of a Nier type mass spectrometer. The pressure in the chamber was raised to about 0.01 mm Hg. Gas mixtures of the hydrocarbons and nitric oxide were prepared in the gas reservoir of the sample introduction system. The hydrocarbons were methane, ethane, propane, ethylene, and propylene with purities higher than 99%. The mixture of methane and nitric oxide exhibited peak of m/e 45 which was not observed in the single system of methane or nitrogen monoxide. At the same time, the peaks due to methane itself decreased. Similar results were obtained for the other mixtures. New peaks of m/e 59 for ethane, m/e 45, 59 for propane, and m/e 59 for ethylene and propylene became greater with increased nitric oxide pressure. It is concluded that these ions were probably formed by the reactions between fragment ions of hydrocarbons and nitric oxide or vice versa; the ions corresponded to CH3NO(+) for m/e 45 and C2H5NO(+) for m/e 59. (Author abstract modified)

516 APTIC NUMBER 17122

Sirotkin, G. D.
EQUILIBRIUM IN MELTS OF THE NITRATES AND NITRITES OF SODIUM AND POTASSIUM. Russ. J. Inorg. Chem. (English translation from Russian of: Zh. Neorgan. Khim.), 4(11):1180-1182, Nov. 1959. 6 refs.

The dissociation of sodium and potassium nitrates and nitrites with air was investigated at 550-700 deg. Dissociation of sodium and potassium nitrates was reversible, with the direction of the reaction determined by the temperature and concentration of nitrite in the melt, and also by the cation. Equilibrium oxygen pressure was influenced by the nongaseous decomposition products, the liquid nitrites. Decomposition was accompanied by the absorption of 27 kcal/mole for NaNO2 and 26 kcal/mole for KNO2. Equilibrium constants are given for the dissociation reactions at different temperatures. Calculated equilibrium oxygen pressures at 600-700 deg suggest that nitrite is easily oxidized by small amounts of oxygen at temperatures below 400 deg, thus explaining why a melt of potassium nitrate and nitrite employed as a heat transfer fluid and thermostat fluid in certain catalytic processes loses nitrite below 400 deg.

517 APTIC NUMBER 16693

Squire, J. M. and William A. Waters
THE ADDITION OF PHENYL RADICALS TO SULPHUR DIOXIDE. J. Chem. Soc., 1962:2068-2069, 1962. 4 refs.

Experiments were undertaken to determine the nature and reactivity of the radical-sulfur dioxide adducts of co-polymers formed when olefins and sulfur dioxide combine in the presence of a peroxide catalyst. Reaction products obtained by passing SO2 through a dry, decomposing solution of benzoyl peroxide in boiling benzene included 4% diphenyl disulfone. Diphenyl sulfone could not be detected. The yield of diphenyl disulfone rose to 14% when SO2 was passed through benzoyl peroxide in chlorobenzene at 100 deg. The absence of chlorinated disulfone indicates that sulfone radicals produced by phenyl-sulfur dioxide reactions are too unreactive to attack benzene or chlorobenzene. Benzyl phenyl sulfone was formed when SO2 was passed through benzoyl peroxide in toluene, but this product is also attributed to the addition of phenyl radicals. It is another indication that phenyl radicals combine with the sulfur atom in SO2 to yield a stabilized free radical which the unpaired electron is again associated with the sulfur atom.

518 APTIC NUMBER 16654

Staudinger, H. and B. Ritzenthaler
A STUDY OF HIGH POLYMER COMPOUNDS; 104th REPORT: THE ADDITION OF SULFUR DIOXIDE TO ETHYLENE DERIVATIVES. (Ueber hochpolymere Verbindungen, 104.Mitteil.: Ueber die Anlagerung von Schwefeldioxyd an Aethylen-Derivate). Text in German. Chem. Ber., vol. 68:455-471, 1935. 48 refs.

Derivatives of high polymer compounds develop through the

addition of sulfur dioxide to ethylene are hetero polymers, the constitution of which is similar to high molecular ozonides and peroxides. The conditions under which monomer or polymer products are formed were investigated. The reaction of SO2 with simple ethylene derivatives is slow; SO2 reacts with ethylene only in the presence of peroxide containing catalysts. Butadiene hydrocarbons are converted more rapidly; the polymerization is accelerated by peroxide containing catalysts. No SO2 could be added to vinylchloride and acrylic acid. Propylene reacts with SO2. The hetero polymer which develops thereby is insoluble in all organic solvents. With the conversion of butadiene derivatives, monomer sulfones develop apart from the high polymer sulfones. The monomers are stable and cannot be converted into polymers. High polymer butadiene sulfones developed at rapid reaction; monomers developed at slow reaction. Poly-butadiene-sulfones and poly-ethylene-sulfones are crystallized. Like the polypropylene sulfones, they are insoluble in organic solvents but soluble in concentrated sulfuric acid. The monomer sulfones are, however, easily soluble in organic solvants, in water, in concentrated sulfuric acid, and in nitric acid. A step by step description of the preparation of the various sulfones is given.

519 APTIC NUMBER 16986

Stephens, E. R., W. E. Scott, P. L. Hanst, and R. C. Doerr
RECENT DEVELOPMENTS IN THE STUDY OF THE ORGANIC CHEMISTRY OF THE ATMOSPHERE. J. Air Pollution Control Assoc., 6(3):159-165, Nov. 1956. 5 refs. (Presented at the 21st Midyear Meeting, the American Petroleum Institute's Division of Refining, Montreal, Que., May 16, 1956.)

A special reaction vessel and infrared absorption cell with a multiple-reflection system were designed to detect the products of the photolysis of organic compounds with nitrogen dioxide in concentrations as low as a few tenths ppm. The transitory formation of ozone by the photolysis of nitrogen dioxide in oxygen was demonstrated; it was shown that if the fast back reaction between ozone and nitric oxide is suppressed by the addition of nitrogen pentoxide to react with the nitric oxide, the ozone will quickly accumulate in the system. Other products observed were aldehyde, alkyl nitrate, formic acid, carbon monoxide, carbon dioxide, water, and an unknown compound later identified as an acyl-nitrogen compound. Aside from ozone, this compound is considered the most important product of photochemical reactions. Its role in the mechanism of nitrogen dioxide-organic compound photochemical reactions is discussed. It is believed that free radicals arising during the oxidation of organic material play a part similar to that of nitrogen pentoxide. That is, they react with nitric oxide to form the acyl-nitrogen compound, allowing ozone to accumulate in the system. The mechanism explains the parallelism between the rate of the compound formation, the rate of ozone formation, and the rate of nitrogen dioxide disapperance. It also explains the production in nitrogen dioxide-organic compound-air mixtures of ozone in concentrations in excess of the initial nitrogen dioxide concentration.

520 APTIC NUMBER 17195

Suzuki, Satoru
CHEMISTRY OF AIR POLLUTION (1). (Taiki osen no kagaku hanno -- Joron, sono tenbo). Text in Japanese. Kagaku Kogyo (Tokyo), 21(2):251-254, Feb. 1, 1970. 13 refs.

A series of theories about the chemistry of air pollution is presented, and the history of pollution and its problems are described. The flow of people to urban centers and the pattern of city life have increased exhaust materials. Lately, the air pollution problem has become internationalized, as illustrated by an episode occurring near the American-Canadian border. Carbon dioxide has not been considered to be an air pollutant, but its future concentrations will constitute a problem. The first problem to appear in the history of air pollution was that of smog. Though effective control methods exist, air pollution by sulfur dioxide is next in importance. The sulfur dioxide problem will be solved sooner or later, and further problems will not arise in this connection. Primary pollution is distinguished from chemical pollution, namely secondary pollution and radioactive pollution. Air pollution by smog and sulfur dioxide is primary pollution. But the primary pollutants can be converted into other harmful substances, that is, secondary pollutants. A famous example of a secondary air pollutant is the Los Angeles smog caused by ozone. Though no plant releases ozone into the atmosphere, organic compounds and nitrogen dioxide become the source of ozone in the presence of sunlight. In a subsequent article, the photochemical reactions of air pollutants will be explained in detail.

521 APTIC NUMBER 17120

Swofford, H. S., Jr. and H. A. Laitinen
AN ELECTROCHEMICAL INVESTIGATION OF THE REDUCTION OF NITRATE IN NANO3-KNO3 EUTECTIC AT 250 C. J. Electrochem. Soc., 110(7):814-820, July 1963. 21 refs. (Presented at the Electrochemical Society Meeting, Los Angeles, Calif., May 6-10, 1962.)

Molten NaNO3-KNO3 eutectic is well suited for use as a high-temperature solvent having a 2.5v range of potentials available for observation of oxidation-reduction reactions involving solutes of fundamental electrochemical interest. Studies carried out at 250 C demonstrated that the peak phenomenon observed at approximately -1.65v in cathodic polarization curves using various microelectrodes and dropping mercury was identified with the beginning of the irreversible reduction of NO3(-), limited by the precipitation of Na2O at the electrode surfaces. It appeared that the after-peak current limiting process was the rate of dissolution of the N2O film, which determined the rate of reduction necessary to sustain a steady state. The anodic and cathodic limits of potential were observed to represent the evolution of NO2 gas (+1.2v) and reduction of alkali metal (-2.8v). The subsequent reaction of the deposited alkali metal with NO3(-) produced a colorless, odorless gas, and oxide ion in amounts which indicated N2 as the reduction product. (Author abstract modified)

522 APTIC NUMBER 16658

Takeuchi, Nobuhiko and Yoshiya Namba
ABSORPTION OF SULFUR DIOXIDE. p. 241-250, 1964 (7) 16 refs. Translated from Japanese. Franklin Inst. Research Labs.,

Philadelphia, Pa., Science Info. Services, 15p., July 1969.

The measurement of the rate of sulfur dioxide absorption into a laminar jet was performed to investigate the effect of chemical reaction between SO2 and OH(-) in liquid phase on the rate of SO2 absorption from gas phase, and also the mechanism of chemical reaction between SO2 and OH(-) in liquid phase. Flow in the jet was shown to be uniform and parallel with the axis, with absorption taking place according to the basic equation of diffusion. The effect of chemical reaction on the rate of gas absorption was expressed by the following equation: beta yields 1 plus 0.88q(1.2), where beta is the ratio of mass transfer coefficient accompanied by chemical reaction to the coefficient without it, and q, the ratio of the initial concentration of OH(-) to the saturated concentration of SO2 in solution. This formula greatly resembles the theoretical equation, derived under the assumption of instantaneous irreversible second-order reaction, except for a slight difference in the power of q. It is therefore concluded that within the present time range of contact time, SO2 is absorbed into NaOH aqueous solution with instantaneous irreversible second-order reaction, and that the effect of the chemical reaction on the absorption velocity is expressed by the equation given above. (Author summary modified)

523 APTIC NUMBER 17253

Tamehiro, Masaki
CHARACTERISTIC OF OIL BURNING STACK AND ITS MAINTENANCE. (Juyu sensho ni okeru entotsu no kino to hoshu kanri no jissai). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(3):175-182, March 15, 1966.

The determination of an effective chimney height and several technical problems of its maintenance were discussed. Stack smoke problems can be solved partly by the collective smoke emission method instead of an individual smoke emission method which does not push the smoke high enough into the atmosphere because of downwash and downdrought phenomena. The kinetic energy produced by collective smoke emission pushes the smoke to an effective height by the effect of momentum. Heat energy is increased which accelerates the rising smoke and makes the smoke dispersion more effective with less influence of downwash and downdrought. Sulfur dioxide concentrations can also be reduced by the collective smoke emission method in large thermal power plants. Stack smoke from a collective chimney rises high enough, passes through the atmospheric inversion layer, and the sulfur dioxide concentration around ground surface is lower. The effective height of a chimney needs to be a least 2.5 times higher than the building, so the smoke rising is not hindered by the surrounding buildings or by geographical conditions. Gas efflux speed should not be less than 15 m/s. A theory states that to avoid downwash, gas efflux speed should be more than 2 times the average wind speed at the end of a chimney, although the relationship between fluctuation of the emission gas quantity and gas efflux speed should be taken into consideration. In a case where a boiler is designed to adjust unstable gas amounts, an additional air duct may be installed to regulate the efflux speed, along with an effort to promote effective smoke rise by use of a fan, while simultaneously suppling the proper amount of air to the gas in order to reduce the absolute quantity of sulfur. Because snow fume generation is closely related to chimney temperature, both ammonium injection into a chimney and low O2 combustion is a boiler to prevent chimney corrosion was advised. Other aspects of chimney maintenance and repair were discussed.

524 APTIC NUMBER 16979

Terrell, J. H. and I. Schmeltz
CIGARETTES: CHEMICAL EFFECTS OF SODIUM NITRATE CONTENT. Science, 160(3835):1456, April 8, 1968. 7 refs.

Cigarettes with sodium nitrate added produce smoke that is less tumorigenic and toxic in mice, contains less particulate matter, benzo(a)pyrene, nicotine, and phenol than does smoke from standard cigarettes. The effect of NaNO3 on the qualitative and quantitative composition of the vapor phase of tobacco smoke was studied. Data showed that addition of NaNO3 leads to significantly greater quantities of undesirable vapor-phase constituents, such as nitrogen oxides, acetaldehyde, acrolein, and acetonitrile. Acetaldehyde and acrolein stongly inhibit ciliary movement. Certain nitrogen oxides were implicated in ciliostasis. The addition of NaNO3 may also lead to the formation of new compounds of questionable activity.

525 APTIC NUMBER 16653

Towell, G. D., C. P. Strand, and G. H. Ackerman
MIXING AND MASS TRANSFER IN LARGE DIAMETER BUBBLE COLUMNS. Inst. Chem. Eng. Symp. Ser. (London), no. 10:91-100, 1965. 18 refs. (Paper 10.10.)

Factors affecting bubble size, gas hold-up, and liquid-phase mass transfer coefficients in large diameter sparged columns were examined. The air-water studies showed that the liquid mixing and hold-up characteristics are much different thatn in a small diameter laboratory column. Small columns exhibit very little axial mixing and high gas hold-up, whereas large diameter columns are essentially one well mixed stage in the liquid phase, and have a lower gas hold-up. The type of sparger had comparatively little effect on bubble size throughout most of the column; bubble sizes were found to be independent of gas flow-rate and height of the column because of a balance between coalescence and break-up rates. Coalescence and break-up rates were measured and found to be consistent with data for liquid-liquid systems in stirred vessels. The bubble size data corresponded well with a correlation developed for stirred vessels in which dissipation of power was one of the correlating parameters. The dissipation of power is directly related to the gas rate. A hold-up correlation was developed for utilizing a slip velocity which contains separate terms for the bubble rise velocity relative to the surrounding liquid and for the circulation patterns in the liquid. A large portion of the increase in the (liquid mass transfer coefficient) (the interfacial area per volume gas-liquid mixture) with gas superficial rate is due to the increase in interfacial area. The mass transfer coefficient was well correlated at high gas rates by the Calderbank equation developed for stirred vessels and at low gas rates by the Bowman and Johnson single bubble correlation. Further work should be directed towards the effects of liquid physical properties.

(Author conclusions modified)

526 APTIC NUMBER 16798

Umeda, Tomio
OPTIMAL DESIGN OF AN ABSORBER-STRIPPER SYSTEM. Ind. Eng. Chem. Process Design Develop., 8(3):308-317, July 1969.

The absorber-stripper system, which has a complicated structure with recycle of absorbent as well as recovery of heat, has been successfully optimized by the Complex method developed by Box. The system contains five independent design variables which have to be decided so as to minimize some objective function, like production cost, under various constraints. Like other optimal seeking methods, the Complex method requires several trials by varying initial conditions for checking that the result is the global minimum, rather than a local one, but this does not lessen its applicability to the optimal design of process systems. (Author's Abstract)

527 APTIC NUMBER 16666

Vaska, L. and S. S. Bath
REVERSIBLE ADDITION OF SULFUR DIOXIDE TO FOUR-COORDINATED METAL COMPLEXES. J. Am. Chem. Soc., 88(6):1333-1335, March 20, 1966. 17 refs.

As part of a program concerned with finding analogies for molecular oxygen in its reversible reaction with the square-planar iridium complex, trans-(IrCl(CO)(ph3P)2), a search was made for reactions of the latter with small molecules which would remain undissociated in their adducts with the metal complex. One result of this inquiry, the reversible addition compound of (IrCl(CO)(Ph3P)2) with SO2, is described. Benzene or toluene solutions of the yellow complex, (IrCl(CO)(Ph3P)2), react almost instantly with gaseous SO2 at 25 deg producing green solutions from which green crystals are deposited on standing; these crystals of the 1:1 adduct are diamagnetic and stable in air. On heating, the SO2 adduct loses SO2 and the complex is reverted to the starting material. The infrared vibrational frequencies of the coordinated SO2 ligand in the Ir and Rh adducts are given, together with those of SO2 and the SO2 groups in three complexes reported previously. The sulfur in SO2 may be regarded as a poor sigma donor and as a moderate pi acceptor through the availability of empty d-pi orbitals, a situation somewhat analogous to that in carbon monoxide. In other words, a lower oxidation state and/or lower coordination number of the central metal atom imply a lower S-O bond order. It is concluded that (SO2)IrCl(CO)(Ph3P)2) may be formally regarded as a sulfoxylo (SO2(2-)) complex of IR(III) or, perhaps more correctly, as an Ir(II) compound containing formally SO2(-).

528 APTIC NUMBER 16662

Vlcek, A. A. and F. Basolo
THE REACTION OF PENTACYANOCOBALTATE(II) ION WITH SULFUR DIOXIDE AND WITH TIN(II) CHLORIDE. Inorg. Chem., 5(1):156-158, Jan. 1966. 8 refs.

In the course of studies on the oxidation-reduction properties and the coordination ability of Co(CN)5(3-), its reactions with SO2 and with SnCl2 were investigated. Color changes are described resulting from the introduction of a mixture of SO2 and N2 into an aqueous solution of CoCl2 and KCN in the molar ratio of 1:5; the same result is obtained from treating a solution of Co(CN)5(3-) with a solution of KHSO3. On the basis of its composition, the compound is formulated as containing two Co(CN)5 groups connected with a bridge containing one sulfur atom. This is supported by potentiometric titration and by infrared spectrophotometry. A second reaction is described when a methanol solution of SnCl2 is added to an aqueous solution of CoCl2 and KCN in the molar ratio of 1:5. In this case, the reaction is not straightforward and depends strongly on the rate of mixing of the solutions and on the concentration of SnCl2 present. With slow and very efficient mixing, potentiometric and spectrophotometric studies show a consumption of 1 mole of SnCl2 per 2 mols of Co(CN)5(3-), again strongly suggesting the formation of a binuclear compound with SnCl2 as a bridging group. In general, the reaction shows the same pattern as that with SO2 and some other compounds; thus, a binuclear complex is most probably formed as the primary product of the reaction which then decomposes rapidly, giving a monomeric compound; the monomer is relatively stable and loses the tin(II) ligand very slowly. Both of the reactions described differ somewhat from the reactions of Co(CN)5(3-) with most other reagents studied to date; these differences are briefly outlined.

529 APTIC NUMBER 16663

Vogt, Lester H., Jr., J. Lawrence Katz, and Stephen E. Wiberley
THE CRYSTAL AND MOLECULAR STRUCTURE OF RUTHENIUM-SULFUR DIOXIDE COORDINATION COMPOUNDS. I.
CHLOROTETRAAMMINE(SULFUR DIOXIDE)RUTHENIUM(II) CHLORIDE. Inorg. Chem., 4(8):1157-1163, Aug. 1965. 11 refs. (Presented at the American Crystallographic Association Annual Meeting, Bozeman, Montana, July 1964.)

The Ru-SO2 complex, (RuII(NH3)4(SO2)Cl)Cl, has an orthorhombic unit cell, a equals 13.962, b equals 9.308, c equals 7.312 A. The space group is Pnam with four formula weights per unit cell. A three-dimensional crystal structure analysis of the complex yielded the positions of all of the atoms but the hydrogens, with a discrepancy factor of 0.047 for 1054 independent reflections. The SO2 is a monodentate ligand, coordinated through the sulfur. The bond distances and bond angle in the coordinated SO2 are approximately the same as in free, solid SO2 and the Ru-N, Ru-S, and Ru-Cl bond lengths are comparable to those observed in other platinum group complexes. Preliminary X-ray and infrared data on the (RuII(NH3)4(SO2)Br)Br, (RuII(NH3)5(SO2))Cl2 and (RuII(NH3)5(SO2))Br2 complexes indicate that in each case the SO2 ligand is coordinated through sulfur (Author abstract modified)

530 APTIC NUMBER 17161

Voronin, G. F. and A. M. Evseev
THERMODYNAMIC PROPERTIES OF LIQUID LEAD-TIN ALLOYS. Russ. J. Phys.

Chem. (English translation from Russian of: Zh. Fiz. Khim.), 33(10):373-375, Oct. 1959. 8 refs.

A thermodynamic study of the lead-tin system in the range 730-790 C, accomplished by measuring the vapor pressure of the lead, is described. A simple continuous weighing method was developed for determining the activities of metals in liquid alloys; the method is a variation of Knudsen's method for vapor pressure determinations. An effusion chamber, consisting of a 0.3 quartz ampoule with a 2.37 mm diameter opening was used, the shape of the ampoule ensuring a constant rate of evaporation. Temperature was controlled to 2 deg and measured using a platinum-rhodium thermocouple in the quartz tube and a potentiometer. The evaporation rate was measured by following the rate of contraction of the quartz spring, using a cathometer, with an accuracy of 0.005 mm. The thermodynamic functions for a number of lead alloys were calculated. It was found that liquid lead-tin alloys exhibit molecular non-uniformity.

531 APTIC NUMBER 15811

Ward, J. W. and H. W. Habgood
THE INFRARED SPECTRA OF CARBON DIOXIDE ADSORBED ON ZEOLITE X.
J. Phys. Chem., 70(4):1178-1182, April 1966. 9 refs.

Absorption bands of carbon dioxide on various cationic forms of zeolite X were obtained between 2200 and 2500 reciprocal cm and below 2000 reciprocal cm. Spectra of carbon dioxide adsorbed on the Ca, Sr, and Ba forms showed no evidence of bent or carbonate-like structures such as reported for carbon dioxide adsorbed on LiX, NaX, and KX. This difference is believed to be due to the absence, in zeolites containing divalent cations, of any cations in the highly exposed type-III sites. Carbon dioxide on MgX showed some carbonate-like bands in the 1300-1750 reciprocal cm region, but apparently only partial replacement of monovalent cations was achieved. The spectra of carbon dioxide on both group I-A and group II-A zolites showed a strong band between 2350 and 2375 reciprocal cm, the stronger the electrical field of the cation the higher the frequency. This band was accompanied (in most cases) by two pairs of weaker side bands symmetrically spaced about the central band. It is concluded that the band observed at high pressures at or slightly below 2350 reciprocal cm is due to the physical absorption of carbon dioxide; the bands in the 1300 to 1750 reciprocal cm region with LiX, NaX, and KX to chemisorption; and the band at low pressures between 2350 and 2375 reciprocal cm to adsorption by an ion-dipole interaction.

532 APTIC NUMBER 16692

Westerterp, K. R.
DESIGN OF AGITATORS FOR GAS-LIQUID CONTACTING. Chem. Eng. Sci., 18(8):495-502, 1963. 11 refs.

The influence of relevant process and design variables on the interfacial areas in agitated gas-liquid contactors is discussed. An optimum agitator-to-vessel diameter ratio exists where the total interfacial area is a maximum for a chosen power input to the liquid. The determination of this optimum ratio is demonstrated, along with corresponding values of power input, agitation rate, and shaft rotation speed. It is shown that efficient use of power is obtained with high speed and small diameter impellers, such as six-bladed turbine and four-bladed paddle impellers. It is further indicated that agitator power input and Reynolds numbers are inadequate variables for correlating interfacial areas. The proper design of gas-liquid reactors for specific interfacial areas is based on agitation ratio and agitator-to-vessel diameter ratio. Overloading of an agitator with gas will not occur when the agitation rate is higher than the minimum agitation rate. However, gas-liquid separation is more difficult at high gas loads, with high foam layers forming on top of the dispersion layer. At gas loads greater than 0.10 m/sec and with low viscosity liquids, further agitation is unnecessary. If agitation rates are above the minimum, gas hold-up in the dispersion phase rarely exceeds 40%. (Author abstract modified)

533 APTIC NUMBER 16670

Wyatt, P. A. H.
METHODS FOR CALCULATING THE EXTENT OF DISSOCIATION OF COMPOUNDS IN THE LIQUID STATE. Trans. Faraday Soc., vol. 52:806-815, 1956. 21 refs.

A straightforward application of Raoult's law to the dissociation of a compound in the liquid state shows that explicit values of the extent, alpha, of dissociation can be calculated from experimental estimates of certain given theoretical expressions, or the corresponding, vapor-pressure derivatives. When the form of dissociation is uncertain, the quantity alpha (a + b)/abs can be determined, in which a and b are the numbers of particles produced in solution per molecule of the two primary dissociation products, and s is the number of molecules of the compound involved in the dissociation equation. For compounds of small dissociation a and b can be evaluated, by a combination of freezing-point (or vapor pressure) and partial molar heat content data, thus supplementing the methods already in use. For compounds of large dissociation, cryoscopic data can be used to test whether or not dissociation is complete. Some nitric and sulphuric acid data are used in illustration of the methods. (Author abstract modified)

534 APTIC NUMBER 16902

Yale, Guy D., Dale L. Ford, and John H. Shaw
THE STRENGTHS OF THE N2O BANDS NEAR 4.5 MICRON. Appl. Opt., 7(4):695-697, April 1968. 4 refs.

The combined intensities at 300 K of the nitrous oxide bands near 4.5 micron were determined to be 1920 plus or minus 50 cm per (atm-cm NTP). Measurements were made on a grating, double beam spectrophotometer. The tests made to estimate the accuracy and reproducibility of this instrument are described. Reproducibility in locating a spectral position is affected by a periodic error of the spectrophotometer than can cause systematic errors up to 4% in absorptance measurements over spectral intervals 10 per cm wide, or less. The average error over wider intervals should be smaller. Both the linearity and reproducibility of the transmittance scale are excellent over the 0.0017 T range. Because of

instrumental drift, experimental errors in total absorptance measurements as obtained by computer calculations increase as the average spectral absorptance decreases, even if long-term drift corrections are applied. The band intensity at 300 K, obtained by plotting total absorptance of the 4.5 micron bands as a function of the H2O amount, is in good agreement with the value obtained by an earlier investigator. This suggests that the double beam spectrophotometer can be used to make accurate measurements of spectra having low total absorptance.

535 APTIC NUMBER 16992

Yemel'yanov, B. V., V. I. Smirnov, and L. M. Tsypkina
ANALYSIS OF THE SYSTEM NACL-KCL-NA2CO3-H2O BY TWO PROPERTIES.
(Analiz sistemy NaCl-KCl-Na2CO3-H2O po dvum svoystvam). Text in Russian. Zavodsk. Lab. (Moscow), 29(10):1174-1175, July-Dec. 1963.

A method is reviewed for determining the composition of ternary mixtures of organic compounds by measuring two of their properties which can be plotted in the form of families of isopleths in the composition diagram of these mixtures, and then finding the composition at the point of intersection of the pair of isopleths corresponding to the pair of measured values of these properties, and a ternary composition diagram is presented for determining the composition of ternary mixtures of inorganic compounds by measuring two of their properties. NaCl, KCl, N2CO3, and water were selected as the constituents of aqueous solutions of NaCl-KCl-N2CO3 mixtures. Unsuccessful attempts were made to use their electrical conductivity and index of refraction or their pH value and index of refraction. Finally, the index of refraction at 25 C was selected and the share of approximately 0.3 n HCl required to neutralize the Na2CO3 present in the mixture. The desired relative amounts of the three recrystallized and desiccated salts were weighed, adding up to the same total weight in every case; each mixture was dissolved in a constant weight of water. The values of the index of refraction were plotted in the composition diagram. The isopleths of the share of approximately 0.3 n HCl required to neutralize the Na2CO3 were identical, except for a scale factor, with the lines of constant Na2CO3-content. As a check on the accuracy of the diagram, the index of refraction was measured at 25 deg and the share of approximately 0.3 n HCl of 6 mixtures and determinations were made from the pairs of measured values of the compositions of these mixtures. The error did not exceed plus or minus 2 weight % in any of the 6 cases.

536 APTIC NUMBER 17273

Zhabrova, G. M., A. V. Shkarin, M. D. Shibanova, and Z. T. Fattakhova
CATALYTIC OXIDATION OF CARBON MONOXIDE OVER FERRIC OXIDE.
(Kataliticheskoye okisleniya okisi ugleroda na okisi zheleza). Text in Russian. Kinetika i Kataliz, 10(5):1062-1067, 1969. 13 refs.

The catalytic oxidation of carbon monoxide over two differently prepared iron oxides at 20-130 C under static conditions was studied. The specific catalytic activity of the iron oxide studied exceeds that reported by other authors. The specific catalytic activity of the specimen with a specific surface of 150 sq m/g was greater over the entire temperature range than that of the specimen with a specific surface of 50 sq m/g with practically the same activation energy of 12 kcal/mole. A possible link between catalytic activity and variation in particle size and magnetic properties of the iron oxide specimens is suggested.

537 APTIC NUMBER 16907

Albright, Randall L. and John A. Babett
POISONOUS EFFECTS OF THE IMPURITIES OF NITROUS OXIDE. J. Oral Surg. Anesthesia Hosp. Dental Serv., vol. 26:1643-1645, Oct. 1968. 2 refs.

Contaminants of nitrous oxide create poisonous effects; proper treatment requires a knowledge of the chemistry involved, its effect on systems, and diagnosis. The formation of nitrous oxide is usually accomplished by heating ammonium nitrate. Contamination may occur from NO, NO2, and N2. If any NO proceeds through the filtering process, it becomes liquid, along with any N2O in the tanks. Since NO is about 30 times more volatile than N2O, it will be the first gas to be let off from the tank. Under normal temperatures, such as during the administration of an anesthetic, nitric oxide may react with oxygen to form nitrogen dioxide which is involatile. Although a given tank may be contaminated with NO, the abundant supply of O2 in the system may actually cause the patient to be poisoned by NO2. The effects of the inhalation of 0.5-2.0% NC or NO2 for five to ten minutes were described. Formation of methemoglobin appears to be one of the greatest problems. This is followed by a drastic fall in PO2, increased PCO2, and a resultant drop in the pH of the blood. Poisoning of the respiratory system may result in hypoxia, hypotension, acidosis, and death. Intense cyanosis may also occur. Treatment includes oxygenation of the patient using 100% oxygen, reconverting methemoglobin with intravenous methylene blue, restoring acid-base balance with intravenous sodium bicarbonate, and the use of vasopressors to combat severe hypotension. Chemical pneumonitis may be treated by bronchial lavage of a basic medium such as corticosteroids. Disulfide and sulfydrite groups are used to combat the effects of poisoning, and bronchodilators may also be used to alleviate bronchospasm.

538 APTIC NUMBER 16916

Alpaugh, E. L., K. A. Phillippo, and H. C. Pulsifer
VENTILATION REQUIREMENTS FOR GAS-METAL-ARC WELDING VERSUS COVERED-ELECTRODE WELDING. Am. Ind. Hyg. Assoc. J., 29(6):551-557, Nov.-Dec. 1968. 6 refs.

Comparative tests were undertaken of the amounts of particulate and gaseous byproducts generated by gas-metal-arc welding and covered-electrode welding processes to determine if the same ventilation requirements apply to both processes. Solenoid values set for inhalation and exhalation times observed in the normal adult male were used to stimulate breathing by a plaster dummy head mounted on a movable welding head carriage. Air samples were taken concurrently inside and outside the welding helmet worn by the dummy. Samples were analyzed for iron oxide, nitrogen dioxide, ozone, fluorides, and carbon monoxide. The gas-metal-arc welding process was represented by five wire electrodes, three of which were flux-cored, and five shielding gases. A standard covered electrode was used for comparison purposes. Contaminant levels generated by the two processes were comparable, and it is concluded that more stringent regulations for either process would be unreasonable. In addition, the study offers evidence that the welding helmet is an effective barrier against the particulate and gaseous byproducts. Consequently, air samples taken adjacent to the helmet yield exaggerated exposure results in welding surveys. Contaminant concentrations are tabulated.

539 APTIC NUMBER 16832

Amdur, Mary O. and Dwight W. Underhill
RESPONSE OF GUINEA PIGS TO A COMBINATION OF SULFUR DIOXIDE AND OPEN HEARTH DUST. J. Air Pollution Control Assoc., 20(1):31-34, Jan. 1970. 10 refs.

Measurement of alterations in the mechanical behavior of the lungs of guinea pigs may be used to assess the irritant potency of air pollutants. By examining the response to an irritant gas alone and in the presence of a known amount of particulate material, it is possible to determine whether or not the particulate material has caused a potentiation of the response. This technique has been used to examine the effect of re-dispersed open-hearth dust on the response to sulfur dioxide. The open-hearth dust used was material obtained from electrostatic precipitators. The system used for re-dispersal of this material will be described. The open-hearth dust alone produced no detectable respiratory response even when used at a concentration as high as 7 mg/cu m. It was also without effect on the response to several levels of sulfur dioxide. The findings were similar for an aerosol of iron oxide. This is in contrast to soluble iron salts which do potentiate the response to sulfur dioxide. These contrasting findings suggest that the potentiation of sulfur dioxide is mediated by solubility in a droplet followed by catalytic oxidation to sulfuric acid. (Author's Abstract)

540 APTIC NUMBER 16774

Amdur, Mary O.
TOXICOLOGIC APPRAISAL OF PARTICULATE MATTER, OXIDES OF SULFUR, AND SULFURIC ACID. J. Air Pollution Control Assoc., 19(9):638-646, Sept. 1969. 62 refs.

An examination of the available toxicological literature indicates that sulfur dioxide itself would be properly classified as a mild respiratory irritant, the main portion of which is absorbed in the upper respiratory tract. The literature further indicates that sulfuric acid and irritant sulfates, to the extent that the latter have been examined, are more potent irritants than SO2. The irritant potency of these substances is affected by particle size and by relative humidity, which factors are probably interrelated. There is evidence, based on animal experiments of one investigator, indicating that the presence of particulate matter capable of oxidizing SO2 to H2SO4 caused a three to fourfold potentiation of the irritant response. The aerosols causing this potentiation were soluble salts of ferrous iron, manganese, and vanadium all of which would become droplets upon inhalation. Insoluble aerosols such as carbon, iron oxide fume, triphenylphosphate, or fly ash did not cause a potentiation of the irritant of sulfur dioxide even when used at higher concentrations. The concentrations of SO2 used in these various experiments were in some cases as low as 0.16 ppm. The catalytic aerosols were used at concentrations of 0.7 to 1 mg/m3 which is above any reported

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levels of these metals in urban air. If the SO2 present as an air pollutant remained unaltered until removed by dilution, there would be no evidence in the toxicological literature suggesting that it would be likely to have any effects on man at prevailing levels. Studies of atmospheric chemistry have shown that SO2 does not remain unaltered in the atmosphere, but is converted to H2SO4. Such a conversion increases its irritant potency. On this basis, the toxicological literature combined with the literature of atmospheric chemistry suggest that sulfur dioxide levels be controlled in terms of the potential formation of irritant particles. Therefore control measures should be, as far as feasible, aimed at both SO2 and particulate material and not against either alone. This article is followed by a discussion by J. Wesley Clayton, Jr. (Author's Abstract Modified)

541 APTIC NUMBER 16813

Beard, Rodney R.
TOXICOLOGICAL APPRAISAL OF CARBON MONOXIDE. J. Air Pollution Control Assoc., 19(9):722-732, Sept. 1969. 32 refs.

The draft Technical Report on Air Quality Criteria for Carbon Monoxide, provided by Dr. John R. Goldsmith of the California Dept. of Public Health is analyzed and discussed. The report is divided under the following headings: Introduction; Theoretical Considerations; Uptake of Carbon Monoxide by Humans; Effect of Carbon Monoxide on the Central Nervous System; Effect of Carbon Monoxide on the Cardiovascular System; Non Hemoglobin Absorptive Systems; Effects of Carbon Monoxide at High Altitude; Adaptation; Endogenous Formation of Carbon Monoxide; Summary; Conclusions. Each of these sections is summarized briefly and reviewed critically. The opinion is that the draft report is a well presented study with conclusions firmly based on the information which is presented. A session summary by Richard D. Grundy and a discussion by B. D. Dinman follow this body of information.

542 APTIC NUMBER 16908

Bing, Richard J.
THE CORRELATION BETWEEN BLOOD SUPPLY AND FUNCTION OF THE HEART. J. Cardiac Surg., 9(5):392-402, Sept.-Oct. 1968. 44 refs.

The correlation between blood supply to the heart and its metabolism and function, with primary emphasis on the physiological correlation of regional circulation with cardiac metabolism and function, was discussed. Methods were described which make possible the determination of nutrient coronary flow in man and in closed chest dogs by means of a coincidence counting method using Rubidium-84. The determination of myocardial contractility is also feasible in man and in closed chest animals. The metabolism of the heart can be determined in the intact animal and man by means of coronary sinus catheterization. However, for the detection of changes in metabolic pathways in heart muscle, sampling of the myocardium is essential. The studies indicated a close relationship between coronary flow and myocardial function, but the speed of the reduction of flow appeared to also be of importance. A marked difference exists in the response of the heart to slow progressive ischemia as compared to sudden ischemia. It is unlikely that blood flow and function are always causally related. In many instances, the same factors which alter flow are responsible for changes in function. Furthermore, changes in flow may be secondary to altered metabolic demands. (Author summary modified)

543 APTIC NUMBER 16790

Brody, Jerome S. and Ronald F. Coburn
CARBON MONOXIDE--INDUCED ARTERIAL HYPOXEMIA. Science, 164(3885): 1297-1298, June 13, 1969. 11 refs.

Inhalation of carbon monoxide produces an increase in the alveolar to arterial oxygen gradient in the presence of veno-arterial shunts or ventilation-perfusion imbalance but has no such effect in normal subjects. The increase in the alveolar to arterial oxygen gradient with rising concentrations of carboxyhemoglobin results from changes induced by carbon monoxide in the shape of oxyhemoglobin dissociation curve. (Author's Abstract)

544 APTIC NUMBER 17072

Bruchhausen, Dieter, Georg Geissler, and Jamil Hascheh
ON THE INACTIVATION OF THE DOMESTIC DUST ALLERGEN BY UV-IRRADIATION. (Ueber Inaktivierung des Hausstauballergens durch UV-Bestrahlung). Text in German. Z. Immunitaltsforsch. Allerg Klin. Immunol., 138 (5):434-438, Nov. 1969. 1 ref.

Extracts from bed feathers, mildew, mixed sorts of flowers, pollen, and domestic dust with and without phenol were exposed to UV-radiation. The domestic dust extracts were irradiated for 30, 60, 90 and 120 minutes. After irradiation, allergic test persons received an interdermal injection of 0.02 ml of the extract. UV-radiation influenced solely the domestic dust extract. The erythema developing after injection were clearly smaller. In a second series of experiments, the influence of UV-radiation on phenol containing domestic dust was studied. Already 30 min of UV-radiation reduced the erythema developing after intradermal injection. Since the same results were obtained with phenol containing as well as with phenol lacking domestic dust, it can be assumed that inactivation of the allergen is not due to the phenol. Rather, it is the irradiate energy which is absorbed by the allergen which changes the molecular structure of the latter, reducing the allergenic effect.

545 APTIC NUMBER 16946

Bruemmer, J. H., B. B. Brunetti, and H. R. Schreiner
EFFECTS OF HELIUM GROUP GASES AND NITROUS OXIDE ON HELA CELLS. J. Cell. Physiol., vol. 69:385-392, June 1967. 13 refs.

The effects of the helium group gases and nitrous oxide on attachment and multiplication of HeLa cells in monolayer cultures were examined. HeLa cells were cultured in Eagle's spinner medium containing 10% fetal calf serum as inoculum for growth experiments. The results showed that at atmospheric pressure, the differences in cell populations between test cultures and N2-control cultures were not statistically different, with the exception of He and Ne.

Helium and Xe, as extremes of the molecular weight spectrum, appeared to stimulate and depress cell multiplication respectively. At superatmospheric pressures, the helium group gases and nitrous oxide depressed multiplication of HeLa cells in monolayer cultures. The effectiveness of these gases in eliciting the pressure-dependent response follows the order from greatest to least, N2O, Xe, Kr, Ar, Ne, and He. The response was correlated with lipid solubility of the gases. Depressions of growth by 4.2 atm Xe is reversible after exposure for one and two days. Cultures exposed to 7.2 atm Xe showed irreversible damage, including cytoplasmic vacuolization. Cell attachment was strongly inhibited by Xe. Thirty-six % of the cell inoculum were not attached after 24 hr. The linear response to increased pressure of N2O, Xe, Kr, and Ar indicated that growth depression is directly proportional to the concentration of the gas in solution. This linear relationship between growth depression and the calculated concentration of the gases in oil at inhibitory pressures suggested that inert gas-lipid interaction may be a major determinant of inhibitory potency. The affinity of the gas for hydrophobic sites within the cell may determine the effectiveness of the gases in evoking a response.

546 APTIC NUMBER 16742

Cassell, Eric J.
THE RIGHT TO A CLEAN ENVIRONMENT. Arch. Environ. Health, 18(5): 839-843, May 1969.

Since the Donora, Pa. smog in 1948, research aimed toward understanding the health effects of air pollution has increased. Substances in the atmosphere have been investigated one by one for their effect on both man and animals. Although experimental evidence supporting a relationship between specific pollutants and any index of disease is sparse, clues to the existence of some causal relationships are often observed. The synergistic action between SO2, H2SO4, and certain aerosols has been clearly demonstrated. Similar examples of synergism can be hypothesized or demonstrated in the complex chemical system that is the atmosphere. There is now recognition of the need for consideration of the total environment when establishing standards and criteria. The attitudes of society and of science are changing so that now, although control of SO2 and particulates appears probable, a more comprehensive view of the problem will be required.

547 APTIC NUMBER 16784

Cederloef, Rune, Lars Friberg, and Zdenek Hrubec
CARDIOVASCULAR AND RESPIRATORY SYMPTOMS IN RELATION TO TOBACCO SMOKING. Arch. Environ. Health, 18(6):934-940, June 1969. 18 refs.

Results of studies of cardiovascular and respiratory symptoms as they relate to tobacco smoking in American twins are compared with the results of similar studies in Swedish twins. Both the Swedish and American twin studies show an association between smoking and certain cardiovascular symptoms. It is questionable, however, whether this excess morbidity is causal. It was not possible to reproduce the association when studying monozygotic smoking discordant twin-pairs. The data on respiratory symptoms on the other hand indicate a strong probability of a causal connection with smoking. Genetic factors play a large role in development of both coronary and respiratory symptoms.

548 APTIC NUMBER 15717

RECOMMENDED AIR QUALITY STANDARDS BASED ON HEALTH EFFECTS. Clean Air Quarterly, 12(41):5-29, Dec. 1968. 52 refs.

Air quality standards based on health effects are desirable levels of air quality which, on the basis of present knowledge, are expected to prevent health hazards or health impairment due to air pollution. Air quality criteria are scientifically sound statements about air pollutant exposures and associated effects. While criteria may be defined at multiple levels, standards for any given pollutant will reflect a single level of air quality which is desirable. Recommended air quality standards and air quality criteria based on health effects are presented for oxidant or O3, CO, SO2, and particulate matter. The interrelationships of the standards and criteria are explored. A synopsis of air monitoring procedures used in California provides brief statements of the principle of the methods used in obtaining the existing data, the limitations of these methods, and suggestions concerning improved air monitoring devices.

549 APTIC NUMBER 17164

Clinton, Marshall
TOXICOLOGICAL REVIEW OF SULFUR DIOXIDE. API (Am. Petrol. Inst.) Toxicol. Rev., 1948:2-5, Sept. 1948. 26 refs.

The best available information is summarized on the properties, characteristics, and toxicology of sulfur dioxide. Suggestions and tentative recommendations are offered pertaining to medical treatments, medical examinations, and precautionary measures for workers who are exposed to sulfur dioxide. Information on the metabolism and mechanism of action of SO2 is not adequate. Some animal experiments indicate that toxic effects of SO2 become apparent after exposures to concentrations above 33 ppm, but guinea pigs have withstood exposure to 150 ppm without developing toxic symptoms. The Meuse Valley disaster of 1930 may be an example of the risk of SO2 pollution since subsequent investigations indicated that the SO2 concentration at the end of four days of fog might have reached 38 ppm. A variety of methods for determining SO2 in air are available. Excellent results are obtained by bubbling the air to be sampled through a solution containing iodine and a large excess of potassium iodide. The excess iodine remaining can be determined by back-titrating with sodium thiosulfate.

550 APTIC NUMBER 15653

Dodo, Hidenori, Mitoshi Hasegawa, Akira Ando, and Kaneo Ueki
AIR POLLUTION IN OTAKE CITY (REPORT 8). (Otakeshi no taikiosen ni tsuite (Dai 8 ho)). Text in Japanese. Hiroshima Daigaku Igaku Zasshi (Med. J. Hiroshima Univ.), 17(1/2):175-181, Feb. 1969. 12 refs.

A medical survey on the influence of air pollution on the residents of Otake city, where petro-chemical industries including major chemical plants have developed since 1959, are presented. The survey conducted on the annual status of registered national health insurance and mortality statistics covered 4 years, starting in 1965, and used the figures of 1959 as a control. The survey dealt with four major diseases which were considered prevailent in industrial areas: respiratory disease including pulmonary tuberculosis, asthma, pneumonia, influenza, and pleurisy; otorhinolarynogological diseases, including nasal catarrh, polypus, angina, otena, tonsillitis, stomatitis, and tympanitis; ophthalmic disease, including conjunctivitis, trachoma, and stye, and cancer including lung cancer, liver cancer, bronchial cancer, stomach cancer, visceral cancer, and uterine cancer. In addition, a disease which was regarded as having a close relationship with air pollution was examined as a typical disease. To obtain the original number of patients distinguished from re-examined patients, new registrants on insurance cards were chosen. Results in Otake city, where air pollution was most noticeable, were compared with those of other cities. Respiratory disease, otorhinolarynogology disease, and cancer did not show any particular relationship with air pollution. A relationship was found only with children's respiratory diseases, especially with asthma among the 0 to 9 years of age range. Mortality statistics did not give any direct proportion to present air pollution status. On the whole, the medical survey conducted concerning air pollution in Otake city did not give particular findings.

551 APTIC NUMBER 16643

Gilbert, R. G. and G. F. Brindle
PHYSIOLOGICAL ASPECTS OF HYPERVENTILATION. Int. Anesth. Clin., 4(4):805-814, Winter 1966. 18 refs.

The advantages and disadvantages of the hyperventilation anesthesia technique are discussed on the basis of clinical observations, clinical studies, and animal studies reported in the literature. In general, hyperventilation does not produce a significant decrease in brain bulk if the PaCO2 is not lowered below 20 mm Hg. Lower levels may reduce the margin of safety in patients with traumatized brain. The excessive lactic production sometimes associated with hyperventilation may be caused by transient liver hypoxia: its symptoms can be lowered cardiac output, a shift to the left in the oxygen dissociation curve, depressed hepatic circulation, and changed pyruvate-lactate ratios. Diminished pulmonary capillary circulation during automatic ventilation can be avoided by maintaining relatively slow inspiratory flow rates. The risk of a fall in cardiac output will be minimal if blood volume is normal, sufficient pause is allowed between respiratory cycles, respiratory pressure is not too high, and if compensatory vasoconstriction is not too greatly depressed by drugs. As a rule, the possible deleterious effects of hyperventilation are few, compared to those that can follow long periods of anesthesia with toxic or depressant drugs.

552 APTIC NUMBER 16822

Goethe, Carl-Johan, Bengt Fristedt, Lennart Sundell, Birgitta Kolsodin, Harriet Ehrner-Samuel, and Karin Goethe
CARBON MONOXIDE HAZARD IN CITY TRAFFIC. AN EXAMINATION OF TRAFFIC POLICEMEN IN THREE SWEDISH TOWNS. Arch. Environ. Health, 19(3):310-314, Sept. 1969. 24 refs.

The hazard of carbon monoxide (CO) exposure in dense traffic was examined in policemen by analysis of the carboxyhemoglobin (COHb) in blood, after they had controlled the traffic during rush hours. The mean COHb levels in smokers were from three to five times higher than in nonsmokers who had a normal, or only slightly increased, COHb concentration in blood. The COHb in smokers tended to decrease when their hours of traffic duty increased. Since the increase of COHb, due to smoking, conceals the effect exerted on COHb by exposure to air in crowded city streets, the biologically significant CO exposure, due to urban air pollution, ought to be evaluated on the basis of the COHb levels in nonsmokers. (Author's Abstract)

553 APTIC NUMBER 15794

Gottlieb, Sheldon F., Allen Cyaeraan, and Albert V. Metz, Jr.
EFFECT OF XENON, KRYPTON AND NITROUS OXIDE ON SODIUM ACTIVE TRANSPORT THROUGH FROG SKIN WITH ADDITIONAL OBSERVATIONS IN SCIATIC NERVE CONDUCTION. Aerospace Med., 39(5):449-453, May 1968. 19 refs.

In an attempt to understand the cellular basis of the biological effects induced by the helium group of elements, the effect of xenon and krypton on the sodium active transport (NaT) across frog skin was determined. Experiments using the short-circuit current technique indicated that approximately 200 psig Xe, 950-1000 psig Kr, and 200 psig N2O reversibly inhibited sodium active transport. The inhibition was not due to pressure per se. The pressures of the gases which reversibly inhibit NaT in the frog skin also induce reversible conduction blockade in frog sciatic nerve. A linear relationship was found to exist between the log of the pressure required to produce nerve conduction blockade and the molecular polarizability of the gases. The involvement of sodium ions in membrane depolarization and in controlling important physiological phenomena suggests that inhibition of sodium ion transport by N2O, Xe, and Kr may be only one of several gas induced effects. Thy gases probably produce other functional and structural cellular changes.

554 APTIC NUMBER 16948

Gottlieb, Sheldon F. and Stephen V. Savran
NITROUS OXIDE INHIBITION OF SODIUM TRANSPORT. Anesthesiology, 28(2):324-326, March-April 1967. 11 refs.

Sacs made of inverted frog skin were filled with an electrolyte solution and exposed in a pressure chamber to nitrogen or nitrous oxide with a small concentration of oxygen. Changes in sodium ion concentration were measured after 20 to 22 hours. With increasing concentrations of nitrous oxide in the range of 100 to 200 psig., inhibition of sodium transport increased. Inhibition

of sodium transport was shown not be to due to pressure per se since 175 psig. nitrogen did not result in inhibition. Inhibition of sodium transport paralleled previous reports of nitrous oxide depression of nerve excitability. (Author abstract modified)

555 APTIC NUMBER 17214

Harley, John H.
DISCUSSION. SOURCES OF LEAD IN PERENNIAL RYEGRASS AND RADISHES. Environ. Sci. Technol., 4(3):225, March 1970.

Human intake of lead was described. The highest concentration of lead was found in New York City. Using 2 micrograms/cu m as the average concentration and a breathing rate of 20 cu m/day, the total annual intake of lead by man would be only 15 mg. The usual values for drinking water were 10 micrograms Pb/liter. The standard consumption of 400-500 liters/year would contribute 4-5 mg Pb/year. The amount of lead found in various diet components was also given. The majority of man's exposure to lead comes from dietary sources. The previously reported suggestion that prehistoric man ingested a smaller amount of lead than modern man by avoiding plant foods was considered unlikely. In actuality, the meat portion of the diet contributes about one-third of the lead and only 10% of the mass of the diet. If prehistoric man avoided plant foods, his dietary intake would most likely be higher than if he was a vegetarian. It was also found that cattle living under conditions described (air concentration 1 microgram/cu m, fodder concentration 5 micrograms/g dry weight) would be taking in about 30 g Pb a year from the diet and about 50 mg from the air. Thus, the animals' fraction of intake from the diet is higher than man.

556 APTIC NUMBER 16905

Holzman, R. S., D. E. Gardner, and D. L. Coffin
IN VIVO INACTIVATION OF LYSOZYME BY OZONE. J. Bacteriol., 96(5): 1562-1566, Nov. 1968. 12 refs.

The effect of exposure of oxidant air pollutants on pulmonary lysozyme in mice and rabbits was studied. Acute exposure of mice or rabbits to ozone reduced the amount of active lysozyme obtained by bronchopulmonary lavage. The effect was proportional to ozone concentration, as well as to the duration of exposure. After 3 hr at 5 ppm, activity decreased approximately 30%. These findings were confirmed in rabbits exposed to 10 ppm ozone for 3 hr. Under these conditions, a 65% reduction in lysozyme was observed. Forty mice were exposed to 5.5 ppm of O2 for 3 hr and sacrificed immediately and at 3 hr intervals thereafter. After 12 hr, extractable lysozyme returned to approximately pre-exposure levels. Mice exposed to 30 ppm nitrogen dioxide for 3 hr showed no change in extractable lysozyme activity. This failure of NO2 to react with lysozyme in the lungs of exposed animals was duplicated. Studies of the release of lysozyme by alveolar cells support the theory that loss of activity is due to in vivo oxidation of lysozyme.

557 APTIC NUMBER 16741

Hounam, R. F., A. Black, and H. Walsh
DEPOSITION OF AEROSOL PARTICLES IN THE NASOPHARYNGEAL REGION OF THE HUMAN RESPIRATORY TRACT. Nature (London), 221(5187): 1254-1255, March 29, 1969. 1 ref.

Studies of the behavior of inhaled radioactive aerosol particles in the human respiratory tract have been started with a study of deposition in the nasopharyngeal compartment. Aerosols were drawn through the nose and mouth at 5, 10, 20, 30, and 40 l/min while the subject held his breath. Monodisperse particles of polystyrene, diameter 1.6-7.3 microns labelled with 82Br, were used. 82Br activity was counted on glass fiber filter paper by gamma-ray spectrometry before and after the aerosol was drawn through the nose and mouth. The results broadly confirmed the accepted relationship between deposition, rate of flow, and aerodynamic particle size, but considerable scatter was found.

558 APTIC NUMBER 17079

Jonek, J., G. Jonderko, and A. Pacholek
HISTOCHEMICAL STUDIES OF KIDNEYS WITH CHRONIC MANGANESE POISONING. (Histochemische Nierenuntersuchungen nach chronischer Manganvergiftung). Intern. Arch, Gewerbepathol. Gewerbehyg. (Heidelberg), vol. 21:347-361, 1965. 23 refs. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 22p., June 1969.

Histochemical studies were conducted on the activity and the distribution of enzymes in the kidneys of rabbits with chronic manganese poisoning. The test rabbits received 1 mg of manganese per kg of body weight in a 1% solution of MnC12.H2O in 0.15 N solution of NaCl every other day. This dose was injected intravenously over a period of 68 days. The histochemical examinations yielded a decrease in the activity of respiratory enzymes along with a simultaneous change in the mitochondria. It was concluded that there are disorders of the respiratory enzyme chain phophorylation. The observed reduction of activity of the alkaline phosphatase along with an enzyme diffusion into the interior of the cytoplasm indicates malfunctioning resorptions and degeneration processes in the kidneys. Chronic manganese intoxication causes a general reduction of the activity of the adenosinetriphosphatase in the nephrons, which leads to a back resorption of sodium and potassium into the kidneys. The acid phosphatase and the acid desoxyribonuclease show a reaction increase with a simultaneous enlargement of the lysosomes leaving a diffuse reaction product. This indicated a degeneration or a higher pinocytosis caused by the toxic amounts of manganese. The unspecific esterases show a reaction increase which pointed to disorders of the fat metabolism. An unchanged activity of the leucine-aminopeptidase indicated that the albumin metabolism is little affected by the toxic manganese concentrations. Different changes in the enzyme activity found in the individual rabbits indicated that each animal reacts differently. (Author summary modified)

559 APTIC NUMBER 17080

Jonek, J., G. Jonderko, and H. Krauze
HISTOCHEMICAL STUDIES OF THE DISTRIBUTION AND ACTIVITY OF THE 5-NUCLEOTIDASE, ADENOSINETRIPHOSPHATASE, ACID PHOSPHATASE, ACID DESOXYRIBONUCLEASE, ALKALINE PHOSPHATASE AND OF THE UNSPECIFIC ESTERASES IN THE LIVER AFTER EXPERIMENTALLY-INDUCED MANGANESE POISONING. (Histochemische Untersuchungen ueber die Lokalisation und Aktivitat der 5-Nukleotidase, Adenosintriphosphatase, sauren Phosphatase sauren Desoxyribonuclease, alkalischen Phosphatase und der unspezifischen Esterasen in der Leber bei experimenteller Manganvergiftung). Intern. Arch. Gewerbepathol. Gewerbehyg. (Heidelberg), vol. 21:241-245, 1965. 17 refs. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 20p., June 27, 1969.

Histochemical studies were conducted on the activity and distribution of enzymes in the liver of rabbits after poisoning with manganese. Seven male rabbits more than 6 months old and weighing between 2.5 and 30 kg, received 3.5 mg manganese per kg of body weight daily in a 1% solution as MnCl2.4H2O in 0.15 M solution of NaCl for 32 days. Injections were given in the marginal vein in the ear. The studies showed that the activities of adenosinetriphosphatase and alkaline phosphatase increased. The 5-nucleotidase and the desoxyribonuclease showed an individual reduction of their activity. The acid phosphatase and the unspecific esterases increased their activity. The activity increase of acid phosphatase and the occurrence of coarse and diffuse reaction products may indicate degeneration processes in the cytoplasm. The enzymatic changes were linked with disorders of the metabolism. (Author summary modified)

560 APTIC NUMBER 17081

Jonek, J. and G. Jonderko
HISTOCHEMICAL STUDIES OF THE BEHAVIOR OF LEUCINE-AMINOPEPTIDASE IN STRIATED MUSCLES AND IN THE LIVER AFTER ACUTE MANGANESE POISONING. (Histochemische Untersuchungen ueber das Verhalten der Leucin-Amino-Peptidase in quergestreiften Muskel und in der Leber nach akuter Manganvergiftung). Z. Mikroskop. Anat. Forsch., vol. 72:417-425, 1965. 16 refs. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 16p., June 27, 1969.

Histochemical studies of the properties of the leucine-amino-peptidase in striated muscle fibers and in the liver of 7 rabbits poisoned with manganese were performed. The rabbits received 3.5 mg manganese per kg of body weight daily in a 1% solution as MnCl2.4H2O in a 0.15 M solution of NaCl for 32 days. The solution was injected into the marginal vein of the ear. The control group consisted of 6 rabbits. In rabbits intoxicated with manganese, an obvious increase of the leucine-amino-peptidase activity was noted in the muscle fibers. In the gland cells of the liver, a decrease in the activity of this enzyme was observed. In the periphery of the liver lobulae and in the connective tissue, the enzyme reaction was higher than in the control animals. It was difficult to interpret the results. The increase in the intensity of the leucine-amino-peptidase activity in the muscle tissue could be due to a direct effect of the manganese ions on this enzyme since they are activators of enzymes. It was hypothesized that manganese poisoning causes the excretion of the leucine-amino-peptidase into the plasma.

561 APTIC NUMBER 16981

Kain, H. L.
HIGHER OXIDES OF NITROGEN IN ANAESTHETIC GAS CIRCUITS. Brit. J. Anaesthesia, vol. 39:382-387, May 1967. 18 refs.

Gas circuit factors such as volume, material composition, placement of leaks, and the presence of soda lime may influence the pattern of exposure to higher oxides of nitrogen of anesthetized patients and staff. Residence time in the circuit is important because the rate of conversion of nitric oxide to nitrogen dioxide depends not only on the amount of oxygen present, but also on the square of the concentration of nitric oxide. Measurements were made to determine the residence time of gases in actual anesthetic circuits. Using the average residence time of 3.5 seconds, the quantities of nitric oxide which would be converted to nitrogen dioxide were calculated for various initial concentrations of nitric oxide and oxygen. Leaks are important because their placement can influence the pattern of gas flow and therefore the residence time of the gases in the circuit. They may also be placed in the circuit either before or after fresh gas passes to the patient, or through a soda lime canister which enables abnormal gases to be detected. Experiments were conducted to observe the absorption of higher nitrogen oxides by soda lime. Results showed that soda lime is temporarily effective as an absorbent but cannot be recommended either as a filter to protect against high nitrogen oxides or as a detector for these contaminants. Nitrogen oxides hasten the deterioration of circuit components, particularly rubber, nylon, and many synthetic polymers. In addition, higher oxides are soluble in rubber. Polyvinylchloride is relatively resistant, but nitrogen dioxide appears to dissolve in it rather freely. Metals vary in their susceptibility to attack. Where moisture is abundant, the effects are likely to be caused by small quantities of concentrated nitric acid. Aluminum, stainless steel, and chromium coating are quite resistant, while copper and brass are very susceptible. Glass is resistant to almost all corrosive agents.

562 APTIC NUMBER 17001

Kapalin, V. and M. Janackova
DEPENDENCE OF THE RED BLOOD CELL PICTURE ON AGE, SEX AND SOME ENVIRONMENTAL FACTORS. (Zavislost cerveneho krevniho obrazu na veku, pohlavi a nekterych zivotnich podminkach deti). Cesk. Pediat. (Prague), 19(2):171-180, 1964. 34 refs. Translated from Czechoslovakian. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services. 17 p.

Basic conclusions on evaluations of the blood cell pictures obtained by examining more than 5000 healthy Czech children during 1953 to 1961 are presented. The basic reference level was obtained for children aged 3-14. In the first period, the evaluation covered the correlation between the red blood cell picture and age and sex of the children. Later stages included comparisons with growth characteristics, diet, atmospheric contamination, and physical activity. It was concluded that the values of the red blood cell picture are an objective image of the adjustment of the child's system to the conditions of external environment and the prevailing way of life. In more favorable conditions, an equal increase is evidenced in the values of the

blood cell numbers and hemoglobin. Even though the red blood cell picture is influenced to a small extent by the sex and age of the child, this dependence is much smaller than that on the living conditions, except for the periods of pre-puberty and puberty growth acceleration. The pattern of living conditions is mostly associated with the quality of diet (especially animal proteins and vitamins) and the atmosphere. Under conditions of suitable diet, higher numbers of Ery and high values of hemoglobin are found in children who are more active and grow faster. The response to changes of living conditions is substantially faster in hemoglobin than in the number of Ery which changes rather slowly. To ensure satisfactory oxygen balance in an environment with a higher level of sulfur dioxide in the atmosphere, the numbers of red blood cells increase without a simultaneous increase in hemoglobin. The volume of individual cells decreases and microcytosis appears. The organism thus ensures an increased activity of the blood-forming elements even without increasing the hemoglobin content.

563 APTIC NUMBER 16936

Kapalin, V. and V. Picko
THE SKELETAL AGE OF SCHOOL CHILDREN AND ITS DEPENDENCES. (Kostni vek u deti skolniho veku a jeho zavislosti). Cesk. Hyg. (Prague), 9(6):342-356, 1964. 16 refs. Translated from Czech. 25p.

The skeletal age of Czech children living in various conditions was assessed by means of X-rays of the left wrist and hand in order to evaluate biological development. The evaluation was based on norms of the skeletal age given by the Greulich and Pyle atlas, and on point evaluation of the individual bones according to Tanner et al. By comparing 2500 values for 7-15 year old children with the level of the normal American aggregates, it was found that Czech girls differ from Americans only insignificantly. The skeletal age of boys in groups between 8 and 15 is 2.4-6.5 months lower. In younger boys, the difference amounts up to 20 months. In comparing the values of skeletal age with the growth values (expressed by deviations of signs from the Czech comparative norm from 1951), a significant dependence of the skeletal age on the relative body height was found. In comparing the skeletal age of children from the country and industrial towns, a significant retardation of skeletal maturation was found in younger school children depending on the volume of air pollution in the living area of the children. (Author summary modified)

564 APTIC NUMBER 16808

Kehoe, Robert A.
TOXICOLOGICAL APPRAISAL OF LEAD IN RELATION TO THE TOLERABLE CONCENTRATION IN THE AMBIENT AIR. J. Air Pollution Control Assoc., 19(9):690-703, Sept. 1969. 22 refs.

A review, with extended discussion, of the tolerable concentration of lead in the ambient air is presented. The principal contributions to the literature with respect to the behavior of lead and its inorganic compounds are reviewed. Four major points discussed are: The body burden of Pb in the general population of the U. S.; the disposition of airborne Pb compounds in the human respiratory tract; chemical evidence indicative of approaching or impending danger from the absorption of Pb compounds; and unusual susceptibility to the absorption of Pb at low rates. (A discussion by Harriet L. Hardy is presented at the conclusion of the document.)

565 APTIC NUMBER 16930

Knananayev, L. I. and Z. V. Karplyuk
EFFECT OF EXTIRPATION OF SOLAR PLEXUS GANGLIA ON THE COPPER AND MANGANESE CONTENT OF BLOOD. (Vplyv ekstyrpatsii vuzliv sonyachnoho spletennya na vmist midi ta markantsyu v krovi.) Ukr. Biokhim. Zh., vol. 38:132-135, 1966. 5 refs. Translated from Ukranian. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 6p., Aug. 16, 1969.

The dynamics of copper and manganese microelements under the conditions of denervation of the pancreas after the extirpation of the right and left solar plexus ganglia were studied by the spectrochemical analysis of blood ash. Experiments were conducted on 12 adult dogs weighing 8-12 kg. After extirpation of the right solar plexus ganglion, the blood copper concentration increased unequally. Blood copper concentration decreased after the extirpation of the left solar plexus ganglion. The manganese content in the blood was more stable. After the extirpation of the right or left solar plexus ganglion, there is an increase of manganese concentration in the blood with a subsequent decrease below normal. Thus, the copper and manganese metabolism depends on the state of various links of the mechanism regulating this metabolism.

566 APTIC NUMBER 15955

Kobayashi, Toshinori
AN EXPERIMENTAL STUDY ON THE RESPONSE TO THE INHALED STIMULANTS: RESPONSE OF MUCOSAE OF RESPIRATORY TRACT. (Shigeki-sei gasu oyobi funjin kyunyu niyoru seitai no hanno ni kansuru jikkenteki kenkyu: Kido nemmaku no hanno ni tsuite). Text in Japanese. Chiba Igaku Zasshi (J. Chiba Med. Soc.), 45(1):35-59, 1969. 66 refs.

Macro- and microscopic observations on the responses of mucosae of the respiratory tract were performed following the inhalation of silica, SO2 gas, or powdered, singly or in combination, on three groups of guinea pigs: those raised routinely (group I); those raised under pasteurized conditions (group II); and those subjected to inhalations immediately after the birth (group III). The concentration of SO2 inhaled for 30 minutes on seven days was about 40 ppm. The concentrations of silica and powdered milk were 1.5 to 2.0 gm/30 min and 3.0 to 5.0 gm/30 min, respectively. The animals who inhaled gas were sacrificed and portions of their respiratory tract tissues were examined by electron microscope or polarized light microscope to detect the small particles within the mucosae. The harmful effects of both silica and organic antigenic dust (powdered milk) were markedly exaggerated in the presence of SO2 gas in the group I: the asthmatic response to the inhaled powdered milk was noted in some cases two months after the inhalation of mixed SO2 and powdered milk. Numerous silica particles were observed in the mucosae of the respiratory tract of group I animals who inhaled silica during or after the inhalation of SO2 gas. The ability to exclude foreign bodies was considered to be reduced by SO2 inhalation. In groups II and III, the silica concentration in

the mucosae of the respiratory tract was higher than in the group 1, indicating the development of an exclusive response to foreign bodies in the mucosae by bacterial infection or by frequent contacts with foreign bodies after birth. The silica and small particles were found to enter through the filament epithelial cells with a high velocity (silica particles, for example, reached the cartilaginous membrane within 16 minutes).

567 APTIC NUMBER 16987

Kubo, Seiji
AIR POLLUTION AND HEALTH OF INFANTS AND CHILDREN. Asian Med. J., 12(4):233-247, April 1969.

A discussion of the relationship between pollutants and meteorological conditions and between pollutants and respiratory diseases is followed by a report on investigations of respiratory symptons in three-year olds and school-age children in Chiba City. Data regarding the first group was obtained from nasal and sputum smears, cultures of pharyngeal and washed sputum, and physical and X-ray examinations. In both studies, children from an agricultural area served as controls. Allergic type respiratory symptons were observed in 22.2% of the three-year olds from the polluted area and in 14.0% of the children from the nonpolluted area. The incidence of colds among the younger children was 2.5 times higher in polluted areas than in the control group. However, colds were more frequent among both groups than among children in the third grade. It is hypothesized that the younger children are more subject to respiratory infections because of an accelerated absorption of antigens. Exposure to high concentrations of sulfur dioxide are thought to bring about the allergic manifestations in the three-year olds living in polluted areas.

568 APTIC NUMBER 17139

Lawther, P. J., J. McK. Ellison, and R. E. Waller
SOME MEDICAL ASPECTS OF AEROSOL RESEARCH. Proc. Roy. Soc. (London), Ser. A, vol. 307:223-234, 1968. 31 refs.

Recent research on the occurrence of particulates and effects of inhalation are reviewed. Analysis of gross samples of London air reveals quantities of oxides, sulfates, chlorides, and nitrates, and almost every element may be detected. Organic compounds are of great variety and include phenols, bases, and many hydrocarbons, chiefly the polycyclic aromatics. Among the latter believed to be carcinogenic are 1,2-benzanthracene, chrysene, 3,4- and 10,11-benzfluoranthene, 1,2- and 3,4-benzpyrene, and 2,3-(o-phenylene)pyrene. Most of the particles and droplets in urban air are of less than one micron diameter and can be studied individually only by electron microscope; cigarette smoke is also discussed as the aerosol having the highest mass and number concentration. The principal particle characteristic determining site of deposition in the respiratory tract is fall speed in air, which in turn depends on particle size and effective density, although if the ratio of maximum of minimum dimension is large, shape can also be important. In general, the smaller and less dense the particle, the further it will penetrate. Particles containing substances soluble in water will grow rapidly in the humid air in the respiratory system and will thus be more readily deposited by impaction or sedimentation; many common urban atmospheric particulates and most of those in tobacco smoke do contain soluble material. Air pollution can produce exacerbations, sometimes fatal, of existing pulmonary disease, although the exact mechanism producing death in sick patients is not yet proven. Much of the work on the effects of inhaling sulfur oxides and particulate matter has been essentially negative; several hypotheses now under consideration for explaining the physiology of the morbidity and mortality effects of pollution are presented. At present, it appears that the role of air pollution is considerable in producing the change from simple to complicated infective bronchitis and emphysema, but is slight in causing lung cancer, particularly in comparison to the overwhelming effect of smoking. The relationship of lung cancer to asbestos inhalation is also discussed briefly.

569 APTIC NUMBER 16964

Linde, Harry W. and David L. Bruce
OCCUPATIONAL EXPOSURE OF ANESTHETISTS TO HALOTHANE, NITROUS OXIDE AND RADIATION. Anesthesiology, 30(4):363-368, April 1969. 16 refs.

Measurements were made of the concentrations of nitrous oxide or halothane in the air of operating rooms while the anesthetics were being administered to assess the exposure of operating room personnel to anesthetic vapors. Exposure of ten anesthetists to radiation in the operating room over a six-week period was also measured. The average concentration of halothane was 10 ppm and nitrous oxide, 130 ppm. Halothane was also found in the air expired by anesthetists, and fluorine-containing substances were found in their urine. No attempt was made to correlate the anesthetist's exposure time to the concentration of halothane in his end-expired air. It was not known if the observed concentrations of nitrous oxide and halothane present a hazard to individuals exposed over many years. Limits are not set for exposure to halothane. It was noted that nitrous oxide and halothane produce bone marrow depression upon long exposure. Whether these inhalation anesthetics will produce leukemia is unknown. The average radiation exposure was 13 milliroentgens per week. This was well below the currently acceptable limit of 100 milliroentgens per week. It does appear possible, however, that anesthetists could easily be exposed to excessive amounts of radiation, and the effects of radiation and anesthesia could be additive. A study on the long-term effects of exposure to low doses of both radiation and anesthesia is in progress.
(Author abstract modified)

570 APTIC NUMBER 16756

Lippmann, Morton and Roy E. Albert
THE EFFECT OF PARTICLE SIZE ON THE REGIONAL DEPOSITION OF INHALED AEROSOLS IN THE HUMAN RESPIRATORY TRACT. Am. Ind. Hyg. Assoc. J., 30(3):257-275, May-June 1969. 17 refs.

The effect of particle size on the regional deposition of aerosols inhaled through the mouth were determined in 92 studies on 34 subjects. The test aerosols were spherical monodisperse insoluble iron oxide particles (specific gravity 2.5) containing radioactive

tags, ranging in median unit density diameter from 2.1 to 12.5-microns. Particles deposited on the bronchial tree were translocated to the stomach by mucociliary clearance which was essentially complete within the first day. The proportion of the initial lung burden of radioactive particles removed during the first 24 hours provided a functional measure of tracheobronchial deposition. A portion of the inhaled aerosol was deposited in the head by impaction. As an impactor, the tracheobronchial tree is more efficient. For each individual subject, head and tracheobronchial deposition increased with increasing particle size. Alveolar depositions decreased with size for particles larger than 4 microns. (Author's Abstract)

571 APTIC NUMBER 15795

Longmuir, Ian S., Stella Sun, and Sheldon F. Gottlieb
EFFECT OF XENON, KRYPTON, NITROGEN AND NITROUS OXIDE ON OXIGEN CONSUMPTION OF RAT LIVER SLICES. Aerospace Med., 39(12)1287-1289, Dec. 1968. 25 refs.

An attempt was made to discern interference with oxygen consumption of rat liver slices at one atm by four widely differing inert gases: nitrogen, krypton, xenon, and nitrous oxide. Experiments were conducted in polargraphic cells with saline solutions equilibrated with partial oxygen gas pressure from 0-700 Torr. For each run, the reciprocal of the respiration rate was plotted against the reciprocal of the pressure of oxygen. A straight line was obtained within each batch of liver slices, whether or not N2, Xe, Kr, or N2O was present. It is concluded that the inert gases tested have no detectable effect on the respiration rate of rat liver slices.

572 APTIC NUMBER 16697

Matz, Gregory J., Christen G. Hattenborg, and Duncan A. Holaday
EFFECTS OF NITROUS OXIDE ON MIDDLE EAR PRESSURE. Anesthiology, 28 (5):948-950, Sept.-Oct. 1967. 4 refs.

The increase in pressure occurring in the middle ear following inhalation of nitrous oxide was studied by taking gas samples from the tympanic bulla of five anesthetized cats and making pressure measurements at this site. Inhalation of nitrous oxide caused a slow rise in pressure in the middle ear of all cats studied. The pressure rose slowly over 10-15 min until peak pressures from 12-40 cm of water were obtained. The eustachian tube usually opened as the peak pressure was achieved, producing a temporary drop in pressure. After 25 min, middle ear pressure remained constant. The increase in pressure correlated with the rise of nitrous oxide concentration to 21-23%. In the cats there was no evidence of rupture in the tympanic membrane, presumably because the Eustachian tube opened before pressure sufficient to cause a perforation developed. In humans, however, it is possible that nitrous oxide inhalation might be partly responsible for tympanic perforation, hemotympananum, and serous otitis media as sequelae of general anesthesia.

573 APTIC NUMBER 16924

Maziarka, S. and E. Mroz
EFFECTS OF AIR POLLUTION ON THE CONDITION OF THE PREVENTIVE APPARATUS OF THE EYE IN SCHOOL CHILDREN. (Wplyw zanieczyszczen powietrza atmosferycznego na stan aparatu ochronnego oka dzieci szkolnych). Text in Polish. Roczniki Panstwowego Zakladu Higi., 19(1):31-38, 1968. 14 refs.

The effect of air pollution on the eye conjunctiva was studied in winter and spring of 1966. The study was carried out on 444 school children, 10 years of age, in Zabrze and Nowe Tychy. Unlike Nowe Tychy, Zabrze has a considerable degree of air pollution (dust content in the air is 0.3 mg/cu m and there is a high content of SO2), while the social environment of all the children is about the same. Physical development of children from both towns was compared. A relationship was observed between air pollution and occurrence of inflammatory conditions in the eye conjunctiva. Eighty-five per cent of the children from Zabrze suffered from the latter, compared with only 55% from Nowe Tychy. Examinations were carried out both directly and cytologically. Dust was found in the eyes in 15.4% of the cases from Zabrze and only in 1.5% from Nowe Tychy. A higher occurrence of tonsils enlargement and lymphatic glands changes was observed for children from Zabrze. Air pollution is believed to have the same effect on inflammatory conditions of both the eye conjunctiva and respiratory system. Thus the examination of changes in eye conjunctiva is a simple and sensitive method of determining the injurious effect of air pollution on human health.

574 APTIC NUMBER 16794

McMillan, Russell S., Daniel H. Wiseman, Bernard Hanes, and Paul F. Wehrle
EFFECTS OF OXIDANT AIR POLLUTION ON PEAK EXPIRATORY FLOW RATES IN LOS ANGELES SCHOOL CHILDREN. Arch. Environ. Health, 18(6): 941-949, June 1969. 10 refs.

Lung function of two samples of Los Angeles elementary school children was assessed twice monthly for 11 months by two examiners using the peak flowmeter. The two samples of children were located in areas with different average levels of oxidant air pollution. No significant changes in peak expiratory flow rate (PEFR) were found which correlated with acute changes in air pollution. Higher PEFR means and greater variance were found in the school exposed to higher ambient oxidant concentrations. These differences may have been related to the difference in the frequency of upper respiratory infections in the two groups. (Author's Summary)

575 APTIC NUMBER 16740

Middleton, John T.
AIR POLLUTION CONTROL. PREVENTIVE MEDICINE. Arch. Environ. Health, 18(5):834-838, May 1969. 4 refs.

Although our knowledge of the health effects of air pollution is incomplete, the evidence that is available demonstrates that air pollution is guilty of killing and disabling people, and that it is capable of doing far more widespread damage than it has already

done. Four types of evidence that link air pollution to specific health detriment are: Studies of major epidemics that have accompanied acute air pollution conditions during relatively short time periods; statistical studies of past illness and death as correlated with geographic locations and other factors associated with air pollution; epidemiological studies of death and respiratory function as related to variations in air pollution; and laboratory studies of responses by animals, and in some cases by human beings, to exposure to various pollutants or combinations of pollutants. Studies of evidence from all of these sources only point the way to understanding some of the effects of air pollution on health. However, the best preventive medicine in dealing with air pollution is control at its major sources. The Air Quality Act of 1967 has provided tools for achievement of effective control of air pollution on a regional basis. Some of the activities resulting from implementation of this Act are discussed.

576 APTIC NUMBER 16928

Mor, C., M. Perelli-Ercolini, and M. Sforza
MALIGNANT TUMORS OF THE RESPIRATORY TRACT AND AIR POLLUTION. PART 2. FIRST EVIDENCE OF THE CARCINOGENIC EFFECT OF AIR POLLUTION PRODUCTS FROM THE CITY OF MILAN. (Tumori maligni dell'apparato respiratorio ed inquinamenti atmosferici. Nota II. Prime esperienze sull'effetto cancerogeno di prodotti dell'inquinamento atmosferico della citta' di Milano). Text in Italian. Arch. Ital. Patol. Clin. Tumori, vol. 9:56-61, 1966. 7 refs.

An extract was administered subcutaneously to a set of rats which contained the polycyclic hydrocarbons contained in atmospheric dust, so as to compare its carcinogenic capacity with that of 3,4-benzopyrene. The average percentage of hydrocarbon constituents in the extract was as follows: pyrene, 9.6%; anthracene, 1.7%; fluoranthene, 9.1%; 1,2-benzoanthracene, 29.6%; 1,2-benzopyrene, 15.6%; 3,4-benzopyrene, 17.5%; 1,2-benzoperylene, 14.9%; and coronene, 2%. Atmospheric dust which has absorbed a determined quantity of 3,4-benzopyrene was administered to a second group of rats. The rats used were of the Sprague-Dawley strain, with an average weight of 150 grams. Three injections, 20 days apart, containing 5 mg benzopyrene suspended in almond oil, were given to 20 rats; 10 other rats were given the same injections, but with a different concentration of benzopyrene; 13 rats were given 0.5 g of atmospheric dust, from which the hydrocarbons had previously been extracted; 13 rats were injected with the hydrocarbon extracts from the dust; 10 rats were injected with hydrocarbon extracts of a different concentration; and 18 rats were given oil containing atmospheric dust treated with benzopyrene. The animals treated with atmospheric dust from which the hydrocarbons were removed did not develop tumors. Hydrocarbons obtained from atmospheric dust have about the same carcinogenic activity as that of benzopyrene, both in terms of the number of tumors induced and the time needed for them to develop. In the case of the rats treated with benzopyrene absorbed by the dust, the occurrence of the tumors was less frequent and more delayed.

577 APTIC NUMBER 16947

Munson, Edwin S. and H. Curtiss Herrick
EFFECT OF NITROUS OXIDE ON VENOUS AIR EMBOLISM. Anesthesiology, 27(6):783-787, Nov.-Dec. 1966. 26 refs.

The effect of nitrous oxide on the median lethal dose (LD50) of intravenously injected air was studied in rabbits. Determinations were performed in similar animal groups anesthetized with 1.0% halothane and with 0.5% halothane combined with 72-76% nitrous oxide. In the halothane group, the LD50 was 0.55 ml/kg; in the nitrous oxide group, it was 0.16 ml/kg. The difference in values was explained on the basis of differential solubility of nitrous oxide and nitrogen in the blood. The finding of a reduction in LD50 value by a factor of 3.4 shows good agreement with theoretical calculations. It was suggested that it may be hazardous to administer high concentrations of nitrous oxide to patients in whom the possibility of air embolism exists. (Author abstract modified)

578 APTIC NUMBER 16967

Ostiguy, G. L. and Margaret B. Becklake
SOLUBILITY OF NITROUS OXIDE IN HUMAN BLOOD. J. Appl. Physiol., vol. 21:1397-1399, July 1966. 14 refs.

The solubility of nitrous oxide in blood was studied in 24 men and 16 women, aged 17-75 years; in 4 subjects with thyrotoxicosis; and in 4 subjects with hyperlipidemia. Blood measurements were made on 25-30 ml of venous blood drawn in heparinized syringes. Analyses were begun as soon as possible after sampling. No significant differences were found between the groups; no consistent age trend was demonstrated. Inter-subject variation of the solubility coefficient of nitrous oxide in blood was minimal. The constancy of nitrous oxide solubility in blood validates the use of a single value to calculate pulmonary blood flow from nitrous oxide uptake (the indirect Fick principle). Computed pulmonary blood flow with be in error by no more than plus or minus 3.5%. Group mean differences due to inter-subject variation would be about 0.1%, indicating that in survey work, an assumed value can be used without sacrificing precision. (Author abstract modified)

579 APTIC NUMBER 16917

Parbrook, Geoffrey D.
EFFECTS OF PROLONGED NITROUS OXIDE ON WOUND HEALING. Brit. J. Anaesthesiology, vol. 39:619-612, 1967. 16 refs.

The antimitotic effect of nitrous oxide on surgical wound healing was studied in rats. Two aspects of healing were investigated: wound strength by the use of wound tensiometry and the rate of cicatrization and epithelial growth by assessing the rate of healing of a small area of full thickness skin loss. Female rats were anesthetized and a 4-cm-long incised wound was then made and closed. Three groups of seven rats each, were exposed to 25% nitrous oxide, 21% oxygen, and 54% nitrogen or to 60% nitrous oxide, 21% oxygen, and 19% nitrogen. The duration of exposure to the gases was three days. After exposure the animals were kept for three days and then killed. No effect on wound strength was detected in rats treated with 25 or 60% nitrous oxide. Similarly,

no significant difference was present in the rate of healing of the area of full thickness skin loss after two days of treatment with nitrous oxide. The results suggest that nitrous oxide need not be dangerous to postoperative healing during a limited period of treatment permitted by its marrow toxicity.

580 APTIC NUMBER 16919

Parbrook, Geoffrey D.
EXPERIMENTAL STUDIES INTO THE EFFECT OF NITROUS OXIDE ON TUMOUR CELL GROWTH. Brit. J. Anaesthesiology, vol. 39:549-553, 1967. 12 refs.

The effect of nitrous oxide on the growth of two types of ascites tumor in mice was investigated. In two trials, mice were injected with tumor cells, divided into three groups and exposed to one of the following atmospheres: air; 25% nitrous oxide; or 40% nitrous oxide. After treatment, the volume of ascites fluid and the concentration of cells were measured. The nitrous oxide treatment significantly lowered the number of cells grown in the case of Ehrlich ascites tumor but had no effect on the growth of 2146 tumor. Two further studies were made in which treatment with nitrous oxide preceded injection of tumor cells; these failed to reveal any effect on tumor growth. Nitrous oxide may have some therapeutic value if tumors in humans can be shown to be sensitive to its antimitotic action. Previous studies showed that a nitrous oxide-oxygen mixture at 2 atm protect mice against lethal doses of irradiation, particularly in the cell population of bone marrow. Consequently, there may be a therapeutic application for hyperbaric nitrous oxide and irradiation in treatment of selected tumors.

581 APTIC NUMBER 16780

Peak, M. J. and William L. Belser
SOME EFFECTS OF THE AIR POLLUTANT, PEROXYACETYL NITRATE, UPON DEOXYRIBONUCLEIC ACID AND UPON NUCLEIC ACID BASES. Atmos. Environ., 3(4):385-397, July 1969. 19 refs.

Some reactions between the air pollutant peroxyacetyl nitrate (PAN) and isolated bacterial deoxyribonucleic acid (DNA) are presented. PAN causes a reduction in genetic transforming activity, melting temperature and viscosity of the DNA. PAN also reduces the infectivity of bacteriophage. It is shown that the intensity and type of reaction is pH dependent, and that the reaction depends upon the presence of a rapidly dissipated transient molecule produced from PAN as it enters solution. Furthermore, PAN modifies some nucleic acid bases, when freshly gassed into aqueous solutions of the base. The susceptibility sequence to PAN attack is thymine, guanine, uracil, cytosine, adenine. No reaction was detected above pH 5, and the reaction rate increases as the pH is lowered. One of the reaction products is CO2, which is excised from the 2-carbon of thymine. This reaction predominates at pH 4, whereas at pH 2 at least 5 reaction products are produced, including CO2. (Author's Abstract)

582 APTIC NUMBER 16819

Rosenkrantz, Harris and Rosa Sprague
BIOCHEMICAL SCREEN TO INVESTIGATE WHOLE SMOKE AND VAPOR PHASE EFFECTS IN MICE. Arch. Environ. Health, 18(6):917-924, June 1969. 26 refs.

House lung tissue exposed to cigarette smoke was used to determine dry weight, oxygen consumption, glycogen, lactate, ribose, DNA, and RNA. Two smoking machines provided either whole body or head exposure and permitted comparison of whole smoke with vapor phase. Dry weights of lung tissue increased in mice undergoing whole body exposure to whole smoke but not when vapor phase was used. Whole smoke induced an elevation in lung glycogen, lactate, and DNA without alteration in oxygen uptake, ribose, and RNA. Vapor phase increased DNA and decreased lung lactate. Nucleic acid levels and oxygen consumption were unchanged in liver tissue but glycogen stores were markedly reduced by whole smoke and not by vapor phase. The effects on carbohydrate metabolism may reflect a general stress reaction while DNA alterations suggest a hyperplasia response and macrophage infiltration. (Author's Abstract)

583 APTIC NUMBER 16650

Rowe, George G., Cesar A. Castillo, Skoda Afonso, and Charles W. Crumpton
CORONARY FLOW MEASURED BY THE NITROUS-OXIDE METHOD. Am. Heart J., 67(4):457-468, April 1964. 35 refs.

A series of answers considered pertinent to the nitrous-oxide method for measuring cerebral blood flow as applied to man was attempted. An attempt was made to establish whether the procedure as a whole alters systemic hemodynamics. It was concluded that even with the unavoidable, deliberate, and accidental loss of blood during the procedure, the vagaries of anesthesia, the manipulation of catheterization, and the administration of a foreign gas, no hemodynamically or statistically significant changes occurred in the systemic, pulmonary, or coronary circulation. The systemic and coronary hemodynamics of the normal male and female were observed; cardiac output and coronary blood flow were determined in duplicate in 13 consecutive normal women. It was concluded that the human subjects did not show complete hemodynamic stability, the range of variation was not excessive, and statistical testing tends to correct differences related to random variation. It appears that considerable confidence can be placed in results obtained by the nitrous-oxide method, provided that a significant series is investigated and statistical tests are used. When compared with the bubble flowmeter and the rotameter, the method has given an acceptable degree of correlation, indicating that it does measure coronary blood flows. Many disadvantages are inherent in the nitrous-oxide method. Since the method requires cardiac catheterization, its use must be limited to those centers in which catheterization is available and a certain amount of risk is inherent. The limited number of times the study can be repeated in a single subject in a single day are considerable disadvantages.

584 APTIC NUMBER 17205

Rylander, Ragnar
AIR POLLUTION IN OUR SOCIETY. A SYMPOSIUM ORGANIZED BY THE ENVIRONMENTAL HYGIENE DEPARTMENT OF THE NATIONAL INSTITUTE FOR PUBLIC HEALTH. (Luftfororeningar i vart samhalle. Symposium organiserat av omgivningshygieniska avdelningen vid Statens institut for folkhalsan). Text in Swedish. Svenska Nationalforeningen Mjart Lungsjukdomar Kvartalsskrift, 63(4):84-91, July/Oct. 1968.

Air pollution problems were discussed March 13-14, 1968 by experts in four fields: technology, animal experimentation, epidemiology, and conservation of natural resources. The task of isolating medically harmful pollutants is complicated by several unrelated factors such as meteorology, heredity, socio-economic factors, and synergistic effects. The problem of allergens, whether natural or artificial, has been insufficiently studied. Animal experiments with pollutants seem to require higher dosages than experience would indicate, possibly because the effects experienced by humans require a combination of several such factors. A serious problem in Sweden is the matter of emissions from the paper pulp industry. Important from the medical standpoint is a better coordinated system for measuring and reporting air pollution effects on an international scale. New techniques have been developed for studying the functions of animal lungs in vivo: (1) the vibration frequency of the cilia and the secretions of the mucosa are used as indexes of the effects of various pollutants; (2) inhalation of a radioactively tagged polystyrene aerosol is followed by scintillograph measurements to determine the rate of transport away from the lungs; (3) inhalation of a bacteria aerosol, followed by evaluation of alterations in the bactericidal mechanisms of the body; and (4) renal function tests to indicate the organ distribution of various substances. Swedish epidemiologists have studied data obtained from 10,000 sets of twins in an effort to ascertain the effects of certain environmental factors in a situation where the heredity factor remains constant.

585 APTIC NUMBER 16661

Sherwin, Russell P., Valda Richters, Marcia Brooks, and Ramon D. Buckley
THE PHENOMENON OF MACROPHAGE CONGREGATION IN VITRO AND ITS RELATIONSHIP TO IN VIVO NO2 EXPOSURE OF GUINEA PIGS. Lab. Invest., 18(3):269-277, 1968. 27 refs.

Cultures of lung tissue from 23 guinea pigs exposed to low level nitrogen dioxide (10 ppm) and 31 control guinea pigs were evaluated for macrophage congregation, a phenomenon defined as the presence of three or more 'spread' macrophages on a single epithelial cell. There were about 63% more instances of this phenomenon in the exposed group than in the controls, 7.6% vs. 4.5%. The number of macrophages participating in each instance of congregation was also much greater in the exposed group. Congregation apparently represents a special role of the macrophage in the defense system in response to a variety of organisms, including infectious organisms, as judged by a high response in a pneumonia-affected control group. The tissue damage incurred cannot be considered specific for NO2 since it involved control as well as exposed cultures, and not all ambient pollutants were filtered out of the air supply system. Evidence is cited strongly indicating an important role for the macrophage in immunopathologic reactions independent of conventional antibody responses, and a close relationship among NO2 exposure, bacterial infection, and macrophage response. (Author abstract modified)

586 APTIC NUMBER 16796

Shugaev, Boris B.
CONCENTRATIONS OF HYDROCARBONS IN TISSUES AS A MEASURE OF TOXICITY. Arch. Environ. Health, 18(6):878-882, June 1969. 8 refs.

Mice and rats were exposed to vapors of butane, butadiene, isoprene, isobutylene, benzenes, and styrene. The concentrations of hydrocarbons in tissues after exposure were determined by gas liquid chromatography. Lethal concentration (LC50) values for two- and four-hour exposures, and the corresponding LC50 in brain tissues were determined for several hydrocarbons. The hydrocarbon concentration found in the brain correlated with the degree of central nervous system depression and narcosis. Mixtures of butane and isobutylene had a potentiating effect in 10 of 12 experiments, and an additive effect in two experiments. (Author's Abstract)

587 APTIC NUMBER 16837

Speizer, Frank E.
AN EPIDEMIOLOGICAL APPRAISAL OF THE EFFECTS OF AMBIENT AIR ON HEALTH: PARTICULATES AND OXIDES OF SULFUR. J. Air Pollution Control Assoc., 19(9):647-656, Sept. 1969. 45 refs.

This review evaluates the present state of our knowledge of the effect on human health of environmental exposure to oxides of sulfur, sulfates, and particulate matter. The measurements of these pollutants in ambient air are the net results from all sources of pollution in combination with factors influenced by weather and meteorological considerations and cannot therefore incriminate single source, or a single pollutant. Direct effects from acute, high ambient air pollution disasters have been adequately demonstrated. Specific working groups exposed to unusually high levels of these pollutants do not demonstrate dramatic effects. However, the association between the prevalence of chronic respiratory disease in the general population and specific levels of these air pollutants have been demonstrated. The major thrusts of epidemiological investigations have been to study the effects of chronic exposure to ambient levels of smoke and sulfur dioxide. The studies to date have collected and analyzed point-prevalence data and information obtained from retrospective investigations. Although epidemiological investigations cannot prove a cause-and-effect relationship, the consistency of the results is such that one must conclude that a causal association is likely. A discussion by I. J. Selikoff is presented in the appendix. (Author's Abstract Modified)

588 APTIC NUMBER 16761

Stanton, Mearl F., Robert Blackwell, and Eliza Miller
EXPERIMENTAL PULMONARY CARCINOGENESIS WITH ASBESTOS. Am. Ind. Hyg. Assoc. J., 30(3):236-244, May-June 1969. 21 refs.

Three methods have been used to test the carcinogenic response of the lung and pleura of the rat to asbestos. No carcinogenic response of pulmonary epithelium or pleura was noted to either healing infarcts or implanted wax pellets that contained asbestos. Sarcomas of the pleura and pericardium developed in 74 percent of rats in which the pleura was covered with an asbestos-impregnated fibrous glass coat. The fibrous glass alone caused only slight reaction, with complete healing. The last method may serve as an accurate and convenient means of quantitating the neoplastic response of the pleura to asbestos. (Author's Abstract)

589 APTIC NUMBER 16739

Stokinger, Herbert E.
THE SPECTRE OF TODAY'S ENVIRONMENTAL POLLUTION--USA BRAND: NEW PERSPECTIVES FROM AN OLD SCOUT. Am. Ind. Hyg. Assoc. J., 30(3): 195-217, May 1969. 128 refs.

A comprehensive toxicologic evaluation of the potential human health hazards from man-made and natural environmental pollutants (except radiation) from air, water and food has been made to highlight the areas of greatest concern for health agencies in the U.S.A. The judgments are predicated on pollutant levels existing now or in the foreseeable future, and on the hereditary milieu of the population of the continental United States. (Author's Summary)

590 APTIC NUMBER 16965

Theye, Richard A. and John D. Michenfelder
THE EFFECT OF NITROUS OXIDE ON CANINE CEREBRAL METABOLISM. Anesthesiology, 29(6):1119-1124, Nov.-Dec. 1968. 16 refs.

Cerebral blood flow and arterial-sagittal differences for oxygen were measured in unpremedicated dogs maintained at 37.0 C. All were paralyzed, received a spinal anesthetic, and were artifically ventilated. In each of a first group, measurements with and without halothane were carried out with 70% nitrous oxide in oxygen and with 70% nitrogen in oxygen. In a second group, either N2O or N2 was used throughout, and measurements were made in the absence of halothane and at 0.1, 0.4, and 0.7% halothane (alveolar). In the absence of halothane and at 0.1 per cent halothane, theaverage rate of consumption of O2 by the brain was 11% greater with N2O than with N2. At 0.4 and 0.7% halothane, the average rate of consumption of O2 by the brain was greater with N2O but the differences were not significant. It was concluded that N2O per se is not a cerebral metabolic depressant and that the anesthetic action of N2O is not based on generalized cerebral metabolic depression. (Author abstract modified)

591 APTIC NUMBER 16738

Vaughan, Thomas R., Lesta F. Jennelle, and Trent R. Lewis
LONG-TERM EXPOSURE TO LOW LEVELS OF AIR POLLUTANTS. Arch. Environ. Health, 19(1):45-50, July 1969. 29 refs.

One hundred and four beagles have been exposed for 18 months to natural and photochemically reacted auto exhaust, oxides of nitrogen and oxides of sulfur. No differences in single-breath carbon monoxide diffusing capacity, dynamic pulmonary compliance, or total expiratory pulmonary resistance were found between exposed and control animals. Removal of reactive gases in the upper airway was studied during brief exposures in an additional small group of animals. Under these conditions, 100% removal of O3 and SO2, 90% removal of NO2, 73% removal of NO, and no removal of CO or hydrocarbon were found. (Author's Abstract)

592 APTIC NUMBER 16816

Vernon, Ralph J. and Roger K. Ferguson
EFFECTS OF TRICHLOROETHYLENE ON VISUAL-MOTOR PERFORMANCE. Arch. Environ. Health, 18(6):894-900, June 1969. 13 refs.

Effects on visual-motor performance of breathing 0, 100, 300, and 1,000 ppm of trichloroethylene were evaluated by six standard tests. Each concentration was administered in random order to each of eight male subjects for two hours. During each period of exposure, all tests except one were given three times to each subject. The results of each test were submitted to statistical analysis. Compared to control responses, 1,000 ppm of trichloroethylene had adverse effects (P less than 0.05) on performance in the Howard-Dolman, steadiness, and pegboard tests. It had no effect on flicker fusion, form perception, or code substitution tests. The results show that trichloroethylene, under the experimental conditions, adversely affected three tests of visual perception and motor skill at the highest concentration, but had no significant effects at the lower concentrations. (Author's Abstract)

593 APTIC NUMBER 17202

Vuylsteek, K.
AIR POLLUTION AND NONSPECIFIC CHRONIC RESPIRATORY AFFECTIONS. (Luchtverontreiniging en chronische aspecifieke respiratoire aandoeningen (CARA)). Text in Flemish. Arch. Belges Med. Sociale, Hyg., Med. Travaile Med. Legale (Brussels), 27(6): 388-393, June 1969.

Chronic bronchitis, frequently promoted by pollution, is one of the leading causes of reduced working efficiency. Statistics produced by the Belgian National Institute on Sickness and Disability in 1967, based on a survey of 83,797 cases of more than 66% disability over a 3-year period, gave the following etiologies: 23.18% are attributed to cardiovascular illness; 8.5%, to pulmonary tuberculosis; and 18%, to illnesses of the respiratory tract, excluding TB. About two-thirds of the last group is attributed to chronic bronchitis. Figures are given from British studies to illustrate the high socio-economic cost of chronic respiratory diseases.

594 APTIC NUMBER 16831

Warden, Henry F., Jr.
PNEUMOCONIOSIS DEFINED. Mining Congr. J., 55(9):78-83, Sept. 1969.

Pneumoconiosis, or "dust in the lungs", is a by-product of industrialization and the different species are usually identified by the causative agent (silicosis, asbestosis, etc.). The response of the lungs to a biologically active dust is usually rather specific but may be altered by a combination with a second dust or by the presence of infection in the lungs. It is essential to know the characteristics of the dust (concentration, particle size, physical form, biological activity, and chemical composition) before an accurate diagnosis can be made. The cleansing action of the respiratory tree is described in detail. A critical analysis is made of 1487 patients with a previous diagnosis of pneumoconiosis.

595 APTIC NUMBER 16980

Wasserman, Karlman, John Butler, and Antonius Van Kessel
FACTORS AFFECTING THE PULMONARY CAPILLARY BLOOD FLOW PULSE IN MAN. J. Appl. Physiol., 21(5):890-900, May 1966. 26 refs. (Presented in part at the American Physiological Society Meetings, Atlantic City, N. J., April 1963 and the American Physiological Meetings, Chicago, Ill., April 1964.)

The effects of lung volume, stroke volume, heart rate, exercise, and drugs on the pulsatility of pulmonary capillary blood flow in man were reported. Instantaneous pulmonary capillary blood flow was measured in man using a modified body plethysmograph with a flowmeter in its wall. This opening permits the plethysmograph pressure to remain approximately atmospheric. The flowmeter measures the airflow in and out of the plethysmograph required to keep the pressure atmospheric. The flow is recorded during exhalations following single breaths of 80% N2O-20% O2 or air. The difference in flow during these exhalations represents the rate of N2O absorption from which blood flow is calculated. Factors which theoretically could affect the pulmonary capillary blood flow pulse were studied with an analog computer model of the pulmonary circulation. The analog shows that the amplitude of this pulse should be reduced when the time constant of the precapillary vasculature is increased, if right ventricular flow is unchanged. The amplitide of the pulmonary capillary flow pulse in man is approximated by the relationship peak flow/stroke volume (Qcmax/SV) and peak flow/mean flow (Qcmax/Qc). These ratios are reduced at high lung volume. Physiological increases in heart rate result in no significant change in Qcmax/Qc. When heart rate is increased with atropine, Qcmax/Qc is reduced, but Qcmax/SV is unchanged. Isoproterenol does not alter Qcmax/Qc and Qcmax/SV, although stroke volume is significantly increased. Isometric exercise increases mean and peak pulmonary capillary blood flow in normal subjects. A comparison is presented of cardiac index, stroke index, heart rate, and pulmonary capillary blood flow in patients with mitral valve disease and normal subjects. (Author abstract modified)

596 APTIC NUMBER 16737

Watson, Joseph A., Albert A. Spritzer, Judith A. Auld, and Mary Ann Guetthoff
DEPOSITION AND CLEARANCE FOLLOWING INHALATION AND INTRATRACHEAL INJECTION OF PARTICLES. Arch. Environ. Health, 19(1):51-58, July 1969. 11 refs.

The pulmonary deposition patterns and the clearance rates of insoluble particles from the lungs of rats were measured during the early post-exposure period following inhalation and intratracheal injection. The data were analyzed by assuming that these compartments are cleared sequentially in time via the trachea. Based on these assumptions, the intratracheal injection technique produced a relatively greater deposition of particles in the lower respiratory tract as compared with inhalation. The clearance kinetics of particles from the lungs were similar for particles deposited in equilavent compartments of the pulmonary system by the two methods of exposure, suggesting that clearance from a given lung compartment is independent of the distribution of particles within that compartment. If this inference is valid, the clearance kinetics obtained following intratracheal injection of particles should not differ from those obtained following inhalation, even though the fractional deposition of particles in lung compartments may differ following the two methods of exposure. (Author's Abstract)

597 APTIC NUMBER 16966

Waun, James E., Richard S. Sweitzer, and William K. Hamilton
EFFECT OF NITROUS OXIDE ON MIDDLE EAR MECHANICS AND HEARING ACUITY. Anesthesiology, 28(5):846-850, Sept.-Oct. 1967. 4 refs.

Hearing loss was observed in a few patients following nitrous oxide anesthesia which could have resulted from changes in middle ear pressure incident to increased airway pressure and/or differential solubility of nitrous oxide and nitrogen. Middle ear mechanics were investigated by measuring impedance of sound energy transmission at the plane of the ear drum with a Zwislocki Acoustic Bridge. Hearing acuity was tested before, during, and after breathing nitrous oxide and non-nitrous oxide mixtures, both with and without positive pharyngeal airway pressure. Decreased compliance and increased resistance occurred in all instances, but was greater when nitrous oxide was present. Positive airway pressure appeared to be without effect. The observed changes persisted only in patients receiving nitrous oxide anesthesia for adenotonsillectomy. A conductive-type hearing loss of short duration was also noted for this group. The results suggest that the differential solubility of nitrous oxide and nitrogen is responsible for changes in middle ear mechanics, and that this change may be prolonged and contribute to postoperative hearing loss if normal equilibrating mechanisms are comprised. (Author abstract modified)

598 APTIC NUMBER 16688

Woestijne van de, K. P., M. Afschrift, and A. Bouhuys
PRESSURES, FLOW RATES AND LUNG VOLUMES DURING FORCED RESPIRATION. (Pressions, debits et volumes pulmonaries pendant la respiration forcee). Text in French. Academisch Ziekehuis St. Rafael, Louvain, Belgium, kliniek voor Inwendige Geneeskunde and Pierce (J. B.) Foundation Laboratory, New Haven, Conn., 33p., 1969 (7).

26 refs.

A review is presented on the interrelations between pressure, air flow rates, and lung volume from the point of view of the theory developed by Fry. Methods of determining isovoluminar pressure vs flow rate graphs, lung volume vs flow rate graphs, and lung volume vs time graphs are described. Information on the maximal air flow rates and their physiological variations under normal conditions are considered. The effect of pulmonary diseases on the normal pressure-flow rate-volume interrelations, especially of obstructive syndromes such as pulmonary fibroses and provoked bronchial constrictions is discussed. In conclusion, it is stressed that the isovoluminer pressure vs flow rate and the volume vs flow rate graphs are valuable in promoting a better understanding of the interaction of the different factors controlling the bronchial air channel clearances and thus determining the resistance to air flow. The new approach is definitely of interest in the field of clinical functional exploration. Also, a comparison of these graphs with those of calm respiration enables one to assess at a glance the expiratory reserves still at the patient's disposal.

599 APTIC NUMBER 16830

Wolkonsky, Peter Halia
PULMONARY EFFECTS OF AIR POLLUTION. Arch. Environ. Health, 19(4): 586-592, Oct. 1969. 35 refs.

Current research on pulmonary effects of air pollution is reviewed. The roles of particulates (benign or pathogenic), carbon monoxide, sulfur oxides, nitrogen oxides and oxidants are discussed. Synergism, epidemiology, and pathology are other featured topics. Much useful, though often puzzling, information is being gained on the pulmonary effects of various pollutants. It appears that, if action is to be taken to curb air pollution, it will have to be done in part on the basis of intuition and extrapolation from current research results.

600 APTIC NUMBER 16840

Wright, George W.
AN APPRAISAL OF EPIDEMIOLOGIC DATA CONCERNING THE EFFECT OF OXIDANTS, NITROGEN DIOXIDE AND HYDROCARBONS UPON HUMAN POPULATIONS. J. Air Pollution Control Assoc., 19(9):679-682, Sept. 1969. 14 refs.

Eye irritation is related to sudden increases in the concentration of oxidants, carbon monoxide, aldehyde, and particulates but not to nitrogen dioxide. The respiratory system of healthy persons has not been demonstrated to react to any of these agents at the concentrations thus far reported in community air. There is some evidence that oxidants at levels found in community air aggravate the symptoms and airway resistance of persons who have preexisting chronic obstructive lung disease. The existing evidence does not support the belief that this type of aggravation accounts for fluctuations of mortality in the general population. There are no data upon which to base a judgment of whether or not oxidants, nitrogen dioxide, or hydrocarbons at levels now existing in community air play any role in causation of respiratory disease. (Author's Abstract) This article is followed with a discussion by Robert M. Albrecht.

601 APTIC NUMBER 17230

Yokoyama, Eiji
AN APPARATUS FOR MEASURING EFFECTS OF IRRITANT OR TOXIC GASES ON VENTILATORY FUNCTIONS OF GUINEA PIGS. (Horumottoyo gasubakuro kankino sokuteisochi). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 3(3):159-166, Dec. 1, 1969. 12 refs.

An apparatus is described which is a modification of the Murphy's multianimal test system for measuring flow resistance of lung plus thorax, tidal volume, and respiratory rate of animals during exposure to toxic or irritant gases. The main feature of the present device is that six animals can continuously breath fresh gas, while their ventilatory functions are being measured without interruption. Repeated exposure of the animals to gas is also possible. A sinusoidally oscillating pressure is externally applied to the thorax, and the air flow rate is monitored. The ratio of pressure to flow rate at resonance gives the flow resistance of the lung-thorax system, which is different from the conventionally obtained flow resistance of the airway-lung system. While breathing air, ventilatory values of guinea pig were recorded as follows: flow resistance, 0.47 cm H2O/cc/sec; tidal volume, 2.4 cc; and respiratory rate 92/min. These values were almost constant during a 210 min test. When exposed to sulfur dioxide, guinea pig flow resistance was found to promptly elevate with a fairly good reproducibility. During the period of the test, the animals were enclosed in a body plethysmograph from the neck down made of acrylic resin. The device is useful for a screening test of toxic or irritant gases which cause airway contraction.

602 APTIC NUMBER 17056

Yokoyama, Eiji
COMPARISON OF THE VENTILATORY EFFECTS ON GUINEA PIGS OF EXPOSURE TO SO2 AND NO2. Koshu Eiseiin Kenkyu Hokoku (Bulletin of the Institute of Public Health), 17(4):307-314, 1968. 26 refs.

Quantitative measurements of ventilatory function of guinea pigs were made before, during, and after two-hr exposure to 6 to 90 ppm of sulfur dioxide and 6 to 57 ppm of nitrogen dioxide. A significant increase in the respiratory (lungs plus thorax) flow resistance was caused by exposure to both gases; the rate of increase was generally higher for SO2 than for NO2. However, the direction of respiratory rate response was quite different at concentrations above 6 ppm; it decreased following SO2 exposure and increased following NO2 exposure. A similar pattern was observed for tidal volume response. Five of the 15 guinea pigs exposed to 57 ppm of NO2 died from lung hemorrhage within 48 hrs after exposure. It is suggested that the differences in the ventilatory effects of SO2 and NO2 are due to the gases reaching different areas of the lungs. Within the range of concentrations studied, it appears that NO2 penetrates deep into the lungs, causing a decrease in compliance and a smaller increase in flow resistance. Sulfur dioxide, being taken up by the mucosa of the airway before reaching the peripheral portion of the lungs, could

cause increased flow resistance without a significant change in compliance. (Author abstract modified)

603 APTIC NUMBER 17311

Yokoyama, Eiji
COMPARISON OF THE VENTILATORY EFFECTS OF SO2 AND NO2 - EXPOSURE OF HUMAN VOLUNTEERS. (SO2 oyobi NO2 no kankino ni oyobosu eikyo no hikaku - hito shigansha ni okeru bakuro jikken). Text in Japanese. Sangyo Igaku (Jap. J. Ind. Health), 12(1):4-8, Jan. 20, 1970. 20 refs.

Respiratory mechanisms were studied in eight healthy male volunteers during and following exposure to 36 ppm sulfur dioxide or 15 ppm nitrogen dioxide. An esophagus balloon was inserted through the nose of each subject who was seated in a body plethysmograph. A Dubois pressure type plethysmograph was employed for SO2 exposure, and a Mead variable volume type 71-Krogh spirometer for NO2 exposure. In both cases, the mean value of the pulmonary flow resistance increased significantly at the end of the exposure. No significant difference was observed in other measures of respiratory mechanisms except for one subject, no difference was seen between responses to SO2 and NO2. Additional groups of subjects were exposed to SO2 and NO2 with or without pre-treatment with atropine sulfate. The atropine markedly inhibited the increase in the pulmonary flow resistance during exposure to SO2, but not during exposure to NO2. The result suggests, as regards the cause of airway narrowing, that reflex bronchoconstriction plays a role in the exposure to SO2, while other mechanisms are also involved in the case of NO2.

604 APTIC NUMBER 17055

Yokoyama, Eiji
EFFECT OF EXPOSURE TO THE MIXTURE OF SO2 AND NO2 ON VENTILATORY FUNCTIONS OF GUINEA PIGS. Koshu Eiseiin Kenkyu Hokoku (Bulletin of the Institute of Public Health), 17(4):315-321, 1968. 13 refs.

Six guinea pigs, 280 g-440 g in body weight, were exposed to mixtures containing 18 ppm sulfur dioxide-17 ppm nitrogen dioxide and 37 ppm SO2-32 ppm NO2 and studied for the effects of exposure on their ventilatory function (flow resistance of the lung plus thorax, tidal volume, and respiratory rate). No significant changes were observed in either respiratory rate or tidal volume. In general, the time course of respiratory rate and tidal volume changes was midway between that caused by exposure to the individual gases, which brought about statistically significant percent changes. The results are discussed in terms of complicated interactions between flow resistance, compliance, and lung air volume. It is hypothesized that SO2 and NO2 in combination exert their action independently at different lung sites, with changes in flow resistance determined chiefly by the component SO2. Below a certain level, a mixture may cause fewer overall changes than individual gases. Beyond a certain level, a mixture may become lethal in short intervals of exposure. As a result of exposure to 50 ppm SO2-50 ppm NO2, all animals died from pulmonary hemorrhage. None had died during exposure to 50 ppm SO2 or NO2 alone. (Author abstract modified)

605 APTIC NUMBER 17061

Yokoyama, Eiji
EFFECTS OF ACUTE CONTROLLED EXPOSURE TO NO2 ON MECHANICS OF BREATHING IN HEALTHY SUBJECTS. Koshu Eiseiin Kenkyu Hokoku (Bulletin of the Institute of Public Health), 17(4):337-346, 1968. 34 refs.

The effect of short term exposure to 2.7, 6.2, 12.6, and 16.9 ppm concentrations of nitrogen dioxide on the mechanics of breathing was studied in eight healthy males from 18 to 37 years of age. The subjects were seated in a volume-displacement body plethysmograph and exposed to each concentration for 10 min. Pulmonary flow resistance, pulmonary compliance, and functional residual capacity was measured before, during, and after each exposure period. No subject showed a significant change in flow resistance after exposure to 2.7 ppm; the average increase in flow resistance became significant only at 16.9 ppm. Recovery of the average flow resistance observed at 16.9 ppm was essentially complete 10 min after exposure ended. Combined data on 16.9 and 12.6 ppm exposures showed that the significant increase in flow resistance occurred within 5 min of the onset of exposure. No subject showed a significant reduction in pulmonary compliance. Similarly, functional residual capacity, respiratory rate, tidal volume, and pulse rate were found to be unaffected by all concentrations. Atropine, 0.7 mg in dose, administered subcutaneously prior to exposure did not inhibit the increase of flow resistance. No difference was found between response to NO2 alone or in combination with a submicronic NaCl aerosol. (Author abstract modified)

606 APTIC NUMBER 17027

Yokoyama, Eiji
UPTAKE OF SO2 AND NO2 BY THE ISOLATED UPPER AIRWAYS. Koshu Eiseiin Kenkyu Hokoku (Bulletin of the Institute of Public Health), 17(4):302-306, 1968. 9 refs.

The penetration rates of sulfur dioxide and nitrogen dioxide in the respiratory system were studied by isolating the upper airways of two dogs and three rabbits anesthetized with intravenous pentobarbital sodium. The airway of nose, pharynx, larynx, and the uppermost trachea were isolated from the remainder of the respiratory system by fitting a glass mask to an animal's head. The mask was connected to a glass cannula through which the gases were sucked in for 10-15 min. The rate of uptake was found to be nearly constant during the period of gas passing and 99.7% for 7-87 ppm SO2 and 4-41% ppm, NO2. The differences in the rate of uptake may partly explain the different responses in the ventilatory functions of experimental animals exposed to SO2 and NO2. (Author abstract modified)

607 APTIC NUMBER 17215

Brandt, C. Stafford
DISCUSSION. SOURCES OF LEAD IN PERENNIAL RYEGRASS AND RADISHES. Environ. Sci. Technol., 4(3):224, March 1970.

Previously reported experiments on the sources of lead in ryegrass and radishes were discussed. Atmospheric lead contributes to the lead content of leaves, but other sources make a significant contribution. Actually, one-fourth of the filtered vs unfiltered air data indicated that atmospheric lead is not a contributor to vegetation lead. Intuition and limited data implicated the soil as the other source. The possibility of significant variation in lead content of vegetation caused by variation in the lead content of soil was not dismissed. Statistical treatment of the data was criticized. Combination of all the data was questioned. It was indicated that a foliar spray of water, containing considerable lead, did not increase the lead content of leaves. This raised an interesting question as to how atmospheric lead does increase the lead content of leaves. Although a soluble lead compound, sprayed on a plant, did not enter the leaf, a supposedly insoluble particulate readily entered the leaf.

608 APTIC NUMBER 16704

Brennan, Eileen and Ida A. Leone
SUPPRESSION OF OZONE TOXICITY SYMPTOMS IN VIRUS-INFECTED TOBACCO. Phytopathology, 59(2):263-264, Feb. 1969. 12 refs.

Virus-free tobacco plants and those infected with tobacco mosaic virus were exposed to ozone fumigations in an environmental chamber. A comparison of the effects of the ozone revealed that virus-free plants showed marked necrosis after exposure, while infected plants exposed under the same conditions showed no necrosis. In some tests run during the summer months, both virus-free and virus-infected plants were equally damaged on exposure to ozone. At present the mechanism of protection that virus-infected plants provide against ozone is not known. The presence of the virus apparently hastens the maturation of the tobacco plants. However, high N content or biochemical changes induced by the virus may account for the resistance of infected tissue to ozone damage.

609 APTIC NUMBER 17217

Dedolph, Richard, Gary Ter Haar, Richard Holtzman, and Henry Lucas, Jr.
SOURCES OF LEAD IN PERENNIAL RYEGRASS AND RADISHES. Environ. Sci. Technol., 4(3):217-223, March 1970. 9 refs. (Presented at the American Chemical Society National Meeting, 157th, Division of Water, Air and Waste Chemistry, Symposium on Air Conservation and Lead, Minneapolis, April 1969.)

Experiments were designed to study the role of air, water, and soil lead content as sources of lead in plants. Plants were grown in chambers, with half the samples receiving unfiltered air. The water applied was either lead free or contained 40 micrograms of Pb/liter as $PbCl_2$. Six successive harvests of ryegrass were made, followed by 3 harvests of radishes. Plants were also grown in a greenhouse. Plants were uniformly watered; half received unfiltered air. Radishes and ryegrass were also grown in a field adjacent to a highway in Detroit. Rows planted at right angles started at 20 feet east of the roadway and extended for 500 feet. Soil-lead contents were determined in samples at 20, 40, 70, 120, and 510 feet from the roadway along transects normal to the roadway. Results showed that only air and soil were significant sources of lead. Experiments affirmed that both grass and radish leaves derived 2-3 micrograms of lead/gram dry weight from soil sources. Leaf-lead levels in excess of this were derived from, and quantitatively related to, atmospheric lead concentrations. Lead levels in radish roots were less than or equal to soil-derived-leaf-lead levels. The lead concentration in the edible portion of the radish plant was apparently unaffected by variations in lead concentrations in either soil or air. Collectively, data would not support a contention that the food of prehistoric man contained only a small fraction of the lead in the food of contemporary man, unless it is assumed that prehistoric man assiduously eschewed plants as a food source.

610 APTIC NUMBER 17227

Dochinger, L. S., F. W. Bender, F. L. Fox, and W. W. Heck
CHLOROTIC DWARF OF EASTERN WHITE PINE CAUSED BY AN OZONE AND SULPHUR DIOXIDE INTERACTION. Nature, 225(5231):476, Jan. 31, 1970. 6 refs.

The interaction of ozone and sulfur dioxide causes characteristic symptoms of chlorotic dwarf disease on susceptible eastern white pine (Pinus strobus L.). Sensitive and resistant white pine ramets were exposed to 10 ppha of sulfur dioxide, 10 ppha of ozone, or to mixtures of the two (each in a concentration of 10 ppha). The pines were fumigated for 4-8 hr each day, five days a week, for 4-8 weeks. Symptoms were not observed on any resistant ramets or sensitive control plants. Chlorotic dwarf symptoms of flecking, occasionally accompanied by a shedding of older needles, were noted on most sensitive exposed plants. There was little or no injury to plants treated with one of the gases and moderate injury in those treated with the gaseous mixture. The percentage of mottling on current needles and the premature drop of older needles exposed to the mixture far exceeded the damage to those treated with one gas. This strongly suggests that the two pollutants act synergistically on sensitive white pine plants.

611 APTIC NUMBER 16644

Donavick, William J., Yukio Hara, and Arthur E. Baue
TECHNIQUES FOR SUCCESSFUL CARDIOPULMONARY BYPASS IN THE CALF. J. Surg. Res., 9(2):79-85, Feb. 1969. 15 refs.

An anesthetic technique, developed to allow successful cardiopulmonary bypass in the calf, was described. Ninety calves weighing 61-110 kg underwent cardiopulmonary bypass for various types of valve transplantation. Atropine sulfate was given intramuscularly thirty minutes before induction of anesthesia.

A conical face mask was used to indice anesthesia with 4% halothane, 71% nitrous oxide, and 25% oxygen. High-pressure (25-30 cm H20), large-tidal-volume ventilation before and after bypass, with the lungs inflated but not ventilated during bypass, eliminated the pulmonary complications associated with cardiopulmonary bypass in the calf. Better blood flow with less resistance was achieved by returning arterial blood from the extracorporeal system through both a femoral and an internal thoracic artery. Foaming of the blood was eliminated by an initial heparin dose of 5 mg/kg and half this dose was repeated at 1-hr intervals during bypass. Because of the low incidence of patency, the ductus was not routinely ligated but was closed only when necessary. Excessive cardiac irritability was controlled with a lidocaine HCl sprayed over the surface of the heart. Ventricular fibrillation was prevented by maintaining the blood temperature above 92 F and by maintaining adequate blood flow with sufficient oxygenation during bypass. Rumen distension was reduced by fasting for 24 hours before surgery to decrease the amount of fermentable material. Also, the rumen was decompressed during and after the operation by a 14 gauge 2-inch needle placed in the rumen percutaneously through the flank. This method was used in 40 calves undergoing total homograft valve transplantation, and no deaths resulted from pulmonary complications which, it was suggested, are due primarily to unsatisfactory ventillation.

612 APTIC NUMBER 16950

Dugger, W. M.
RESEARCH INVESTIGATING INTERACTION BETWEEN ATMOSPHERIC OXIDANTS AND LIGHT IN PLANT SYSTEMS. Preprint, 8p., 1968 (?). 20 refs.

Research is proposed for continuing studies on the effect of peroxyacetyl nitrate (PAN) on the photosynthetic mechanism and the components of the Electron Transport System by using a dual wave band spectrophotometer. Earlier research on the effect of the quality of light in PAN damage to plants showed that red light (660 millimicrons) can induce damage response in bean plants while far red light (700 millimicrons) induces protection. Sulfhydryl (SH) compounds in bean plants are synthesized in the light; a strong correlation exists between the effect of plant age, light quality, and photoperiod on SH content on susceptibility of the plants to PAN damage. Also under investigation is the inhibitory effect of PAN on cyclic photophosphorylation by chloroplasts from Black Valentine bean leaves; inhibition in either the dark or the light increases linearly as the PAN is increased, but complete inhibition does not occur in the light; the ligh inhibition requires more PAN than does the dark. In addition to a continuation of the physiological studies on the SH content of bean plants, research is being started to describe the changes at the molecular level responsible for the change in the SH content of bean plants, particularly the increase due to light. Other topics under investigation are the effects of oxidants, especially ozone, on anthocyanin biosynthesis, and permeability and carbohydrate metabolism changes induced by ozone.

613 APTIC NUMBER 16657

Enderlein, H., W. Kastner, and H. Heidrich
THE RESPONSE OF SEEDLINGS OF THE LARIX GENUS, TESTED WITH RESPECT TO SMOKE RESISTANCE, IN THE AREA OF EXTREME SMOKE INJURIES, PARTICULARLY UNDER THE EFFECT OF SEVERE FROST, OR LATE FROST. (Jak reaguji sazenice rodu Larix, zkousene na odolnost proti kouri, v extremni oblasti kourovych skod, zvlaste pod vlivem silneho mrazu, pripadne pozdniho mrazu). Scientific and Technical Society, Prague (Czechoslovakia), Agricultural and Forestry Section, Proc. Conf. Effect Ind. Emissions Forestry, Janske Lazne, Czechoslovakia, 1966, p. XVI-1 to XVI-11. 6 refs. (Oct. 11-14.) Translated from Czech. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, April 24, 1969.

The behavior of seedlings with known resistance to sulfur dioxide was tested by experimental plantings in natural emission areas. In previous experiments, the greater or lesser resistance of larches to smoke was determined genetically. It seemed possible that the production of larches of high smoke resistance, by means of controlled cross-breeding, would be promising. The planting of 468 three-year larches was carried out in an area of extreme smoke injury. The site of the planting was almost flat and the soil was formed from podzoled loose brown soil. Considerable damage was caused by winter frosts and also by severe late frosts. All plants were exposed at the same time and for the same duration to a constant concentration of 0.73 ppm sulfur dioxide. Resistance to smoke is conditioned genetically and is hereditary. Results also showed that the highest rate of injury to seedlings was evidenced in the class of plants with greatest sensitivity to smoke, while frost injuries were definitely distributed over all of them. The hybrids originated by cross-breeding in the presence of L. leptolepis grew more than pure crossings of L. decidua. They were also less sensitive to smoke. It was concluded that growth losses in the areas of heavy emissions can be substantially reduced, both by improving the experimental varieties resistant to smoke and by large-scale selection of the most resistant units.

614 APTIC NUMBER 17057

Heck, Walter W. and Allen S. Heagle
MEASUREMENT OF PHOTOCHEMICAL AIR POLLUTION WITH A SENSITIVE MONITORING PLANT. J. Air Pollution Control Assoc., 20(2):97-99, Feb. 1970. 8 refs.

The highly susceptible tobacco variety Bel-W3 was used to determine the distribution, frequency of occurence, and levels of photochemical oxidant in rural areas within 5 to 75 miles of Cincinnati. A comparison of weekly or seasonal indices of plant damage, compiled by adding the percentage injury of each leaf with weekly oxidant indices, determined from oxidant levels recorded in a laboratory, showed no consistent relationship between weekly oxidant concentrations and weekly plant injury during the summers 1966 through 1968. Observations revealed almost daily injury to the plants, fairly uniform total seasonal injury at all locations, and marked variation in both oxidant and injury from one season to another. The phytotoxic oxidants potential at sites 75 miles from Cincinnati suggest pollution sources other than Cincinnati for the sites. It is possible that all of Southweastern Ohio is affected by phytotoxic air pollution.

615 APTIC NUMBER 16655

Keller, Th.
THE CONTENT OF LEAD IN SPRUCE FASCICLES AS AN INDICATOR OF AIR CONTAMINATION DUE TO TRAFFIC. (Obsah olova ve smrkovem - indikator znecisteni vzduchu pusobeneho dopravou). Scientific and Technical Society, Prague (Czechoslovakia), Agricultural and Forestry Section, Proc. Conf. Effect Ind. Emissions Forestry, Janske Lazne, Czechoslovakia, 1966, p. XVIII-1 to XVIII-14. 8 refs. (Oct. 11-14.) Translated from Czech. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, April 24, 1969.

A chlorotic coloring of the fascicles of spruces and firs was observed in trees planted along the roads, especially in curves and on slopes. It was concluded that this damage was due to the toxic effects of exhaust gases. The lead content of the fascicles was spectrographically determined. The assimilation parts of conifers located along turnpikes showed (in comparison to fascicles from remote regions) an increased content of lead which increases with increasing traffic. The lead content can therefore be considered as an indicator of air contamination due to traffic conditions. The lead content increases with the age of fascicles. The content of lead at the beginning increase with time of exposure, but probably a local equilibrium is established between the sediments and the scrubbing. The lead content shows a strong decrease with the increasing height from the road. The filtration effect of the forest was well demonstrated by fascicle analysis. The largest portion of the lead compounds are captured on the surface of the fascicles, so that poisoning of the vegetation rarely occurs. Measurement of the exchange gases showed the depression of CO2 assimilation even in normal, healthy looking fascicles with increasing lead content. This slowing down of assimilation must be explained in terms of contamination of the surface of the fascicles and by toxic effects of other components of waste gases.

616 APTIC NUMBER 17038

Koeppe, David E. and Raymond J. Miller
LEAD EFFECTS ON CORN MITOCHONDRIAL RESPIRATION. Science, 167(3923):1376-1378, March 1970. 7 refs.

Oxidation of exogenous nicotinamide adenine dinucleotide and succinate by corn mitochondria was measured as a function of lead chloride concentration. Concentrations of 50-60 micromoles/l stimulated oxidation of exogenous reduced nicotinamide adenine dinucleotide by 174-640%, depending on the reaction medium; concentrations of 12.5 micromoles/l inhibited succinate oxidation by more than 80%. When inorganic phosphate was included in reaction medium, the subsequent addition of lead was without effect due to the low solubility of lead phosphate. The addition of lead followed by the addition of phosphate released the inhibition of succinate oxidation by lead but did not decrease the stimulation of oxidation of reduced nicotinamide-adenine dinculeotide by lead. It is significant that the effects of lead seen in the study were observed at very low concentrations and that there was a sharp increase in the magnitude of its influence within a small range of concentrations. When effective concentrations of lead are reached in the atmosphere, there could be a dramatic reduction in plant growth under conditions of phosphate deficiency. (Author abstract modified)

617 APTIC NUMBER 16656

Kohout, R. and J. Materna
SORPTION AND PROPAGATION OF SULFUR DIOXIDE IN THE ASSIMILATION ORGANS OF SOME FOREST WOODY PLANTS. (Sorpce a sireni kysliciniku siriciteho v asimilacnich organech nekterych lesnich drevin). Scientific and Technical Society, Prague (Czechoslovakia), Agriculture and Forestry Section, Proc. Conf. Effect Ind. Emissions Forestry, Janske Lazne, Czechoslovakia, 1966, p. XVII-1 to XVII-6. (Oct. 11-14.) Translated from Czech. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, April 24, 1969.

The extent of localization of sulfur dioxide in the vegetation organs of plants was investigated. Experiments showed that sulfur dioxide is not absorbed in a uniform manner across the surface of the individual tested leaved trees. Increased concentrations of SO2, as evidenced in autoradigrams, was observed primarily on the tips of the leaves and along serrated borders, or along the edge of the leaf, mostly in narrow, but sometimes also broad, diffuse zones. The concentration of SO2 in the tips and borders of the leaves increased within a range of 10-100%. The autoradiograms indicated that penetration of radioactive sulfur compounds into the leaf tissue occurred only with Ulmus effusa and Fagus silvatica. It was also established that sulfur dioxide sorption was highest with Betula verrucosa, Fagus silvatica, and Carpinus betulus. Sulfur dioxide sorption decreased somewhat with Ulmus effusa, Salix caprea, and Robinia pseudacacia. Substantially reduced sorption was observed in acer platancides, Sorbus aucuparia, Acer campestre, and Populus nigra italica. No definite conclusions were drawn about the sorption of sulfur dioxide by the leaves of trees and the migration of sulfur compounds which arose from SO2 within the plant organism. However, it was directly proved that the leaves of many woody plants are really capable of accumulating sulfur dioxide in their marginal portions, even during a very short period, from an environment which contains non-toxic concentrations of the gas.

618 APTIC NUMBER 17225

Lacasse, Norman L.
DISCUSSION. LEAD IN SOILS AND PLANTS: ITS RELATIONSHIP TO TRAFFIC VOLUME AND PROXIMITY TO HIGHWAYS. Environ. Sci. Technol., 4(3):237-238, March 1970. 5 refs.

Contamination of vegetation by lead is discussed in terms of variation of lead levels with time of year and of the effect of automotive exhausts on vegetation adjacent to highways. In a New Jersey study, the highest lead values were found in the fall months. This phenomenon may be related to greater atmospheric stability at that time of the year. It may also be related to factors such as precipitation, driving conditions, and engine performance. It is important to determine whether the difference is amplified or attenuated in localities which differ from New Jersey in their climatic and weather characteristics. While there is circumstantial and real evidence of the relationship between distance from the highway and lead contamination of vegetation, most sampling has been done at relatively large

intervals. With another pollutant of a different nature but coming from the highway, as well as from salt used in ice and snow control, the main effects were limited to a distance of 30 ft. Extensive lead sampling needs to be done within 50 ft of highways.

619 APTIC NUMBER 17216

Lagerwerff, J. V.
DISCUSSION. AIR AS A SOURCE OF LEAD IN EDIBLE CROPS. Environ. Sci. Technol., 4(3):230, March 1970. 6 refs.

The conclusion from a previous experiment that under prevailing experimental conditions, most lead in plants is derived from soil and arterial Pb plays a very minor role was evaluated. The rate at which the plants respond to the Pb present in the environment under the general conditions established was discussed, particularly the question of whether the accumulation of Pb by plants was measured on a steep or on a flat part of the curve, characterizing the relationship between uptake rate and such experimental variables as Pb concentrations in soil and air or air movement in the greenhouse and distance from traffic observed in roadside studies. The net outcome may diminish differences in Pb content that otherwise would occur between plants exposed to the two aerial concentrations of Pb applied. With regard to completeness of data, no measurements were made of crop yield and, by implication, on total uptake of Pb by plants. Soil pH values also were not reported. Data interpretation was also questioned. In discussing the accumulation of Pb by sweet corn grown in the greenhouse, it was stated that the cob contained a higher concentration of Pb than the kernel, and that this distribution would be difficult to explain if the source of the lead were not the soil. This conclusion presumes the knowledge of the pathway followed by Pb taken up by the roots. In stressing the importance of soil-borne Pb relative to that of airborne Pb with regard to the composition of plants grown in roadside soils, the long-term, indirect effects were emphasized rather than the short-term, direct effects of aerial Pb. The broader ramifications included the significance of the effects of aerial Pb on the quality of our food.

620 APTIC NUMBER 17109

MacLean, David C., Delbert C. McCune, Leonard H. Weinstein, Richard H. Mandl, and George M. Woodruff
EFFECTS OF ACUTE HYDROGEN FLUORIDE AND NITROGEN DIOXIDE EXPOSURES ON CITRUS AND ORNAMENTAL PLANTS OF CENTRAL FLORIDA. Environ. Sci. Technol., 2(6):444-449, June 1968. 11 refs.

Six citrus varieties and six ornamental species of economic importance to central Florida were subjected to high concentration-short duration exposures of gaseous hydrogen fluoride or nitrogen dioxide. Postfumigation observations showed that the effects of acute pollutant exposures differed markedly from those of chronic exposures. Hydrogen fluoride exposures of 0.5 to 10 ppm for periods of from 0.5 to 8 hours induced tip, marginal, and intercostal chlorosis and necrosis, and abscission of leaves of most plants tested. Symptoms were most severe on, but not limited to, young leaves. The effect of duration of exposure had a greater influence on abscission of young citrus leaves than did HF concentration. However, the effect of HF concentration on foliar F accumulation could not be separated from exposure time. The NO2 concentrations used ranged from 25 to 250 ppm for periods of from 10 minutes to 8 hours. Nitrogen dioxide damage was characterized by rapid tissue collapse, necrosis, and defoliation. Symptoms were sporadic in appearance, affecting leaves of all ages. The relative contributions of concentration and duration to NO2 induced injury were about equal. (Author abstract modified)

621 APTIC NUMBER 16664

Materna, J.
PRELIMINARY RESULTS OF SYSTEMATIC MEASUREMENTS OF THE CONCENTRATIONS OF SULFUR DIOXIDE IN THE ATMOSPHERE ABOVE THE KRUSNE HORY AREA. (Prvni vysledky soustavneho mereni koncentraci kyslicniku siriciteho v ovzdusi v oblasti Krusnych hor). Scientific and Technical Society, Prague (Czechoslovakia), Agriculture and Forestry Section, Proc. Conf. Effect Ind. Emissions Forestry, Janske Lazne, Czechoslovakia, 1966, p. III-1 to III-16. 6 refs. (Oct. 11-14.) Translated from Czech. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, April 24, 1969.

The existence of fundamental differences and discrepancies in the data on toxic concentrations of sulfur dioxide has led to a program to investigate the relationships between concentration and injury in a series of experiments with the effects of fumes on older spruce seedlings and seedlings of other woody plants; and of utilizing the data obtained from the established network of stations for the automatic recording of sulfur dioxide in the atmosphere of the forests in Krusne hory. The network is partially linked to the extensive control system in the area below Krusne hory, the Podkrusnohori, and in communities in Krusne hory. The purpose of the measurements were as follows: establish the range of SO2 concentrations in this area; compare the measurements with the degree of damage, especially in the old spruce stands; and measure the trends in SO2 concentrations in the area under influence of emissions. A network of four analyzers furnished continuous measurement data obtained at one-minute intervals, showing values of SO2 concentrations in the atmosphere expressed in mg/cu m air. Results of two of them are presented for preliminary evaluation. Results are summarized in tables and suggest the following conclusions: (1) concentrations of sulfur dioxide causing injury to forest plants in both localities are lower than the limits of toxicity presumed so far; and (2) maintenance of levels not exceeding the acceptable level did not protect the spruce stands from injury.

622 APTIC NUMBER 17218

Motto, Harry L., Robert H. Daines, Daniel M. Chilko, and Carlotta K. Motto
LEAD IN SOILS AND PLANTS: ITS RELATIONSHIP TO TRAFFIC VOLUME AND PROXIMITY TO HIGHWAYS. Environ. Sci. Technol., 4(3):231-237, March 1970. 19 refs. (Presented at the American Chemical Society Annual Meeting, 157th, Division of Water, Air and Waste Chemistry, Symposium on Air Conservation and Lead,

Minneapolis, April 1969.)

The lead content of grasses and soil samples along highways was determined. The results show that there is surface contamination of the plants and soils with lead. In addition, five crops - carrots, corn, lettuce, potatoes, and tomatoes - were grown at three distances from highways having various traffic densities. These same crops were grown in the greenhouse in soil from the surface six inches of field plots and in acid-washed sand to which soluble lead was added. Analysis of plants grown in the field revealed that the highest lead levels were associated with the leaves with lower levels in the roots. These same plants grown in the greenhouse exhibited lower levels in the leaves relative to the roots. The results indicate lead was absorbed through the root system in the greenhouse with some translocation to other parts of the plant. The overall results showed that the lead content of plants and soils increased with increasing traffic volume and decreased with increasing distance from highways. Most of the lead accumulation was within 100 feet of the highways. The edible portion of carrots, corn, potatoes, and tomatoes contained the lowest amounts of lead and showed the least effect of increased lead supply. The edible portion of lettuce contained a larger amount of lead. Similar relationships of lead in air, plants, and soils with traffic volume and distance from highways indicate a common source of lead, the gasoline consumed by motor vehicles. (Author summary modified)

623 APTIC NUMBER 16974

Oertli, J. J.
EFFECT OF SALINITY ON SUSCEPTIBILITY OF SUNFLOWER PLANTS TO SMOG. Soil Sci., 87(5):249-251, 1958. 10 refs.

Experiments which demonstrate a relationship between salinity of nutrient medium and susceptibility of sunflower plants to smog are reported. The materials and the methods are described. The effect of smog on leaves of sunflower plants which were growing in solutions of different salinities or at different moisture tension is illustrated. The most severe injury occurred on recently matured leaves; young leaves at the growing points resisted smog. The damage was concentrated more on the apical parts on young leaves, while on slightly older leaves, the large central areas were injured; on even older leaves, the heaviest damage was observed on the basal parts. The injury on opposite leaves was strikingly symmetrical. Both salinity and high moisture tension increased the resistance of sunflower plants to smog injury. Plants grown in a 1-strength Hoagland solution frequently showed more than 50% of the leaf areas chlorotic or necrotic; in an 8-strength solution, there was no visible damage. Such results were obtained consistently during every smog period. Similar patterns of injury resulted when the plants were exposed to sulfur dioxide or the oxides of nitrogen.

624 APTIC NUMBER 16906

Russell, C.
EFFECT OF NITRIC OXIDE AND HYDROGEN SULPHIDE ON RADIATION SENSITIVITY OF SPORES OF BACILLUS MEGATERIUM IN SUSPENSION. Experientia, 22(2):80-81, Feb. 1966. 9 refs.

The effect of nitric oxide and hydrogen sulfide on the radiation sensitivity of wet spores in a buffered suspension was determined. There was a slight sensitization by NO when present during irradiation at a concentration of 0.5% NO in N2. Above that concentration, the sensitivity of B. megaterium spores decreased, being below that in N2 when 100% NO was used. Sensitivity was much lower when irradiation took place in H2S. The enhancement of sensitivity due to pretreatment with NO required a minimum of 12 hours contact with the gas. Four observations showed that the surviving fraction after irradiation in N2 was unaltered by subsequent contact with 100% NO for 30 minutes. It was concluded that the effects of NO on wet spores was qualitatively similar to that found with a suspension of vegetative bacteria. The far greater protection shown by H2S may be a reflection of damage inflicted by NO upon the metabolism of the cell, making it more radiation sensitive.

625 APTIC NUMBER 17182

Schuck, E. A.
LEAD IN SOILS AND PLANTS: ITS RELATIONSHIP TO TRAFFIC VOLUME AND PROXIMITY TO HIGHWAYS. Environ. Sci. Technol., 4(3):238, March 1970.

The results of a study of the lead content in soils and plants and its relationship to traffic volume and proximity to highways are discussed. Crops grown downwind of heavily traveled highways exhibit contamination by the lead particulates present in automobile exhaust. However, it was not demonstrated whether this particulate lead contamination leads primarily to simple surface contamination or actual absorption by the plant. Absorption could lead to a concentrating mechanism which would pose more of a potential danger to the consumer. The effect of simple surface contamination would be limited in that the amount of lead which can cling to a surface is limited. Refinements in experimental techniques are needed to determine whether lead contamination is located on the surface or absorbed by the plant.

626 APTIC NUMBER 17163

Spierings, F. H. F. G.
CHRONIC DISCOLORATION OF LEAF TIPS OF GLADIOLUS AND ITS RELATION TO THE HYDROGEN FLUORIDE CONTENT OF THE AIR AND THE FLUORINE CONTENT OF THE LEAVES. Neth. J. Plant Pathol., vol. 73:25-28, 1967. 5 refs.

The gladiolus variety Snow Princess, which is very susceptible to hydrogen fluoride, was used in field experiments to investigate the correlations between traces of HF occurring in the atmosphere, gradually developing leaf tip injury, and fluorine content of injured leaves. Seven experimental fields were laid out for investigation: one in an industrial area near the sea; one far from any industry but at the same distance from the sea; three on different soil types in Wageningen; and two in pollution free areas. At regular intervals, the plant injury was estimated by measuring the length of leaf tip injury. Fifteen cm lengths of injured leaf tips were cut and analyzed for their

fluorine content. The average HF pollution in the atmosphere was estimated by using filter papers soaked in $Ca(OH)_2$. Fields where HF concentrations were low displayed very slight and very gradually developing leaf tip injury. In the four fields with measurable pollution, more serious injury occurred. The content of HF in the atmosphere also correlated with the fluorine content of the damaged leaf tips. It was concluded that leaf tip injury was caused by HF.

627 APTIC NUMBER 16673

Stein, G.
REGIONAL DIAGNOSES OF SMOKE DAMAGE IN THE FORESTS OF KRUSNE HORY, CONDUCTED BETWEEN 1964 AND 1966, AND THEIR RESULTS. (Metoda velkoprostorove diagnosy kourovych skod v lesich Krusnych hor, uskutecnena v letech 1964-1966, a jeji vy-sledek). Scientific and Technical Society, Prague (Czechoslovakia), Agriculture and Forestry Section, Proc. Conf. Effect Ind. Emissions Forestry, Janske Lazne, Czechoslovakia, 1966, p. VII-1 to VII-16. 15 refs. Translated from Czech. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 17p., April 1969.

Investigations of smoke damage in the Annaberg, Marienberg, Freiberg, Tharandt, and Pirna National Forests of Czechoslovakia from 1964 to 1966 are described; spruce covered 85% of the area surveyed. Analysis of tree rings by borings showed a significant decrease in growth rates of spruce stands in the last 10 years. Spruce fascicles were shown to have the ability to store sulfur, but no relationship to the degree of tree damage was established. Analysis of the fluorine content in bark and of variations in acidity of the humus layer were also carried out, the degree of acidity does not appear to be correlated with the degree of injury. Trace elements found in the humus were in concentrations too small to be phytotoxic. A survey of existing and planned emission sources was made, including nearby areas of Germany, and a permanent network of 12 measurement stations for continuous atmospheric samplings of sulfur dioxide and dust was established along the border between Fichtelberg and Elbe; the stations will also make relevant meteorological observations.

628 APTIC NUMBER 17093

Stolzy, L. H., O. C. Taylor, J. Letey, and T. E. Szuszkiewicz
INFLUENCE OF SOIL-OXYGEN DIFFUSION RATES ON SUSCEPTIBILITY OF TOMATO PLANTS TO AIR-BORNE OXIDANTS. Soil Sci., 91(3):151-155, March 1961. 9 refs. (Paper No. 1254, University of California Citrus Experiment Station, Riverside, California.)

A study was undertaken to determine whether oxygen conditions in the soil-root environment influence plant susceptibility to damage by air-borne oxidants. The materials and methods used are described. The tomato plants subjected to the two low-oxygen treatments could be visually separated from the plants in the higher oxygen treatments the day after the oxygen treatments were applied. The plants in the low partial-pressure treatments had thick, dark green leaves; during afternoons, progressively more wilting was observed. Plants growing in the 10-mm. Hg. treatments appeared to be almost normal in growth in comparison to the control plants. In the 0-10-mm treatments, no new rootlets appeared along the plexiglass bottom during the 80-hour period. In the remaining treatments, the number of rootlets approximately doubled during this period. Maximum damage after fumigation by peroxyacetyl nitrate (PAN) or ozone always occurred on the most recently matured leaves. In cases of severe damage on recently matured leaves, there was always some damage to the apical parts of the young leaves, with no apparent damage to older mature leaves. Tissue damage was the main damage from fumigations with both PAN and ozone in the high oxygen treatments. Silvering and glazing were characteristic of leaf damage at a low level of ozone fumigation. Soil oxygen diffusion rates taken in field plots show that limited oxygen supply to plants could affect the susceptibility of plants to air-borne oxidant damage under field conditions.

629 APTIC NUMBER 16385

Takehara, Hideo
EFFECTS OF AIR POLLUTION ON PLANTS. Preprint, no source given, 4p., 1968 (?).

Current and recommended future research studies by Japanese investigators on the effects of air pollution on plants are reviewed. Local universities and agricultural research stations are emphasizing studies of the possible damage caused by sulfur dioxide, hydrogen fluoride, chlorine, and chromium from industrial sources to farm crops, tea, fruit, forest and mulberry trees, and young silkworms. Systematic basic research is being carried out by national research institutes on such problems as the symptoms and mechanism of injury to crops exposed to HF, and on atmospheric diffusion phenomena; a program is also in the planning stages to study nationally the effects of pollutants on the flowering and fruiting of plants near factories and power stations and in urban green belts. A number of subjects are proposed for high priority in future research planning: these include chronic damage to plants from long-term, low-concentration exposure to pollution as opposed to the more readily known acute symptoms; effects of such pollutants as ozone, nitrogen compounds, and ethylene; improvement of the methodology of field observations and gas chamber tests; the variables in the plants themselves that affect their susceptibility to damage; control methods, including fertilizer improvements, planting and cultivation methods, and shading; selection of smoke-resistant species of various plants; and a listing of indicator plants in urban environments.

630 APTIC NUMBER 17220

Ter Haar, Gary
AIR AS A SOURCE OF LEAD IN EDIBLE CROPS. Environ. Sci. Technol., 4(3):226-229, March 1970. 15 refs. (Presented at the American Chemical Society National Meeting, 157th, Div. Water, Air and Waste Chemistry, Symposium on Air Conservation and Lead, Minneapolis, April 1969.)

The source of lead in some plants that are important in the human diet was determined. Tomatoes, potatoes, wheat, carrots, leaf lettuce, cabbage, snap beans, and sweet corn were grown in filtered and unfiltered air. In all of these crops, except leaf

lettuce, there was no measurable effect on the lead concentration of the edible portion due to lead in air. It seems probable that lead found in plants grown in filtered air was due to lead naturally present in the soil. Only in the case of leaf lettuce was there a measurable difference between the concentration of lead when the plants were grown in filtered and unfiltered air. This difference would add 0.5 to 1% to the daily intake of lead. When these same crops were grown at increasing distances from a heavily traveled highway, there was no measurable effect on lead concentration in the edible portion of tomatoes, potatoes, wheat, carrots, leaf lettuce, cabbage, oats, rice, and sweet corn. Snap beans had a higher lead concentration near the road, which could add about 0.75 to 1.5% to the daily intake of lead. The nonedible portions of the crops, such as corn husks, bean leaves, and the straw of grains, showed 2- to 3-fold increase in lead concentration due to lead in air. (Author conclusions modified)

631 APTIC NUMBER 16645

Thewlis, B. H.
TESTING OF WHEAT FLOUR FOR THE PRESENCE OF NITRITE AND NITROSAMINES. Food Cosmet. Toxicol. (London), 5(3):333-337, Aug. 1967. 16 refs.

The possible content of nitrite and nitrosamines in flour and bread was investigated. A total of 17 samples were exposed to nitrogen oxides for 15 minutes and exhaust gases from a gasoline engine for 1-30 minutes. Samples exposed to nitrogen oxides or exhaust fumes were allowed to stand in stored containers for at least 48 hrs before being analyzed for nitrite or nitrosamines, in order to allow nitrite and any secondary amine present to reach equilibrium concentrations. Neither nitrite nor nitrosamines could be detected in any sample of normal flour or bread examined. Flour which was deliberately exposed to nitrogen dioxide from a chemical generator or from vehicle exhaust gases still contained no detectable nitrosamines. Only when a considerable excess of diethylamine was added under slightly acid conditions to the exposed flour, and the mixture maintained at 70 C for 1 hr, could any diethylnitrosamine be detected.

632 APTIC NUMBER 15881

Biestek, Tadeusz
ACCELERATED CORROSION AND FIELD TESTS: DEVELOPMENT OF RELATION COEFFICIENTS. Metal Finishing, 15(4):44-48, Feb. 1968. 16 refs.

Results of accelerated corrosion tests are of value only if related to natural corrosion conditions by relation coefficients showing the magnitude of acceleration obtained when comparing the results of accelerated and field corrosion tests. Such coefficients were obtained for electrodeposited zinc and cadmium coatings in tests in which the coatings were deposited on panels of low-carbon steel from a cyanide zinc, sulfate zinc, and cyanide cadmium bath. The thickness of the deposited coatings was 1, 2, 4, 7, 15, and 30 micron. In 24-hr laboratory tests, the panels were sprayed with sodium chloride or ammonium sulfate-ammonium chloride solutions, exposed to 2 liters of sulfur dioxide and carbon monoxide, and immersed in hot distilled water or ammonium chloride solutions. Field tests were conducted in urban, industrial, marine, and rural atmospheres, where pollutants include SO2, dust, and sea spray. A comparison of established values of relation coefficients show great differences, depending on the kind of test and atmospheric conditions. The values of the relation coefficients vary from 10 to about 1000 but are most often in the range 20 divided by 100. This indicates a relatively small advantage for the most used acceleration tests. Standard deviations of the relation coefficients are generally under 10%, suggesting that the service life of zinc and cadmium coatings can be accurately forecast on the basis of laboratory corrosion tests.

633 APTIC NUMBER 17196

Burda, P.
INFLUENCE OF THE CHEMICAL COMPOSITION ON THE KINETICS OF ATMOSPHERIC CORROSION OF STEELS. (Einfluss der chemischen Zusammensetzung auf die Kinetik der atmosphaerischen Korrosion von Staehlen). Text in German. Werkstoffe Korrosion, 20(12):999-1004, Dec. 1969. 19 refs.

Atmospheric corrosion tests were carried out between Nov. 1963 and Sept. 1966 at three representative test sites in Czechoslovakia: rural, in Hurbanove; urban, in Prague-Letnany; and industrial, in Usti na Labe, on 3 to 5 100 mm wide, 150 mm high and 1.3 to 1.6 mm thick samples of 19 structural steels. The weight loss K in g/sq m, of the steel samples after 41 to 43, 390 to 401, and 1050 to 1080 days of exposure was determined after removal of the corrosion products in Clarke's solution. In evaluating the test data it was assumed that the weight loss due to corrosion of a steel is a linear function of the contents of its alloying elements which are given in the form: K equals aS + bP + cCu + dC + eMn + fSi + gCr + hV + Q. For each class of steels the domain of variation of the respective set of alloying elements and the values of the coefficients a to h and of the constant Q for each of the three test sites and each of the three exposure durations are given. The validity of this assumption was confirmed by a regression analysis. The contribution of any alloying element in increasing or decreasing thee loss of weight due to corrosion of a given steel under specified atmospheric conditions and exposure duration is given by the (positive or negative) product of the appropriate coefficient and the content of this alloying element in that steel. The present findings show that the magnitude and direction (positive or negative) on the effect of an individual alloying element of a steel on its atmospheric corrosion is different under different atmospheric conditions and exposure durations and that in considering it the effects of its other alloying elements cannot be disregarded.

634 APTIC NUMBER 17132

Krause, H. H., A. Levy, and William T. Reid
SULFUR OXIDE REACTIONS: RADIOACTIVE SULFUR AND MICROPROBE STUDIES OF CORROSION AND DEPOSITS. J. Eng. Power, 90 A(1):38-44, Jan. 1968. 10 refs. (Presented at the American Society of Mechanical Engineers, Winter Annual Meeting, Pittsburgh, Pa., Nov. 12-17, 1967, Paper 67-WA/CD-1.)

The reactions of sulfur dioxide and sulfur trioxide with catalytic surfaces containing iron oxides, alone and in combination with various sodium salts, were investigated. The SO3 concentration gradients above the surfaces were measured using a microprobe technique, showing that as much as 2000 ppm SO3 can exist in a slowly flowing gas stream immediately next to a surface. Radioactive sulfur was employed as a tracer to determine the roles of SO2 and SO3 in reactions with these surfaces leading to formation of alkali iron trisulfates. These measurements indicated that on a molar basis, SO3 is 30,000 times more reactive than SO2 + O2 in forming complex sulfates with a mixture of sodium sulfate and iron oxide. (Author abstract modified)

635 APTIC NUMBER 17159

Rahmel, A.
THERMODYNAMIC CONSIDERATIONS OF THE CORROSION IN SULFATE MELTS: HOW TO PREPARE AND APPLY E/LOG PSO3 DIAGRAMS. (Thermodynamische Gesichtspunkte der Korrosion in Sulfatschmelzen: Die Konstruktion und Anwendung von E/log pSO3-Diagrammen). Text in German. Electrochim. Acta, 13(3):495-505, March 1968. 25 refs.

The construction of E/log pSO3 diagrams for several metals in the ternary eutectic of 78.0 mol % Li2SO4, 13.5 mol % K2SO4, and 8.5 mol % Na2SO4 (melting point 513 C) at 600 C is discussed. The construction is to a large extent analogous to that used by Ingram and Janz for carbonate melts. Characteristic regions are obtained for each metal in which either the metal, the metal oxide, the metal sulfide, or the metal sulfate is stable. The sulfide formation narrows the region in which the metal is thermodynamically stable. The diagrams clearly demonstrate the great importance of SO3 to corrosion. Silver corrosion must be expected at SO3 partial pressures of more than 0.000001 atm. With silver, cathodic protection is possible; with copper, it is possible only at a SO3 partial pressure of less than 10 to the minus eighth power. Iron and nickel cannot be cathodically protected, since the sulfate melt would be reduced which would trigger heavy sulfide corrosion.

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637 APTIC NUMBER 17148

Weintraub, M., S. Goldberg, and A. A. Orning
A STUDY OF SULFUR REACTIONS IN FURNACE DEPOSITS. J. Eng. Power, vol. 83:444-450, Oct. 1961. 5 refs. (Presented at the American Society of Mechanical Engineers Winter Annual Meeting, New York, N. Y., Nov. 27-Dec. 2, 1960, Paper 60-WA-183.)

A study was made of absorption of sulfur from synthetic flue gas by coal ash. When fly ash was placed in a temperature gradient like that in a deposit on a boiler tube, maximum absorption was found in the coldest layer. When held at constant temperature, maximum absorption was found at 1100 F. The amount of absorption was highest for fly ash from furnaces in which serious deposit formation was observed. It was also highest for fly ash containing the highest content of sodium and potassium. The sulfur is probably absorbed as mixtures of normal sulfates, pyrosulfates, and such compounds as potassium-ferric trisulfate. A liquid phase of these compounds in contact with tube metal causes corrosion. The maximum sulfur absorption found at 1100 F coincides with a maximum at the same temperature that has been observed for external tube-metal corrosion. (Author abstract modified)

636 APTIC NUMBER 15656

Rodkey, F. Lee, Harold A. Collison, and Rolf H. Engel
RELEASE OF CARBON MONOXIDE FROM ACRYLIC AND POLYCARBONATE PLASTICS. J. Appl. Physiol., 27(4):554-555, Oct. 1969. 5 refs.

The influence of previous carbon monoxide exposure on the rate of CO release by polycarbonate and acrylic plastics was demonstrated. Transparent polycarbonate and acrylic plastics were exposed to air, nitrogen, and oxygen in glass containers at 25 C. Carbon monoxide was released from both types of plastic into the gas phase. The amount of CO released from a given plastic sample was similar in the presence of air, nitrogen, or oxygen but was markedly increased following previous exposure to CO. The data indicate that the CO release from these materials is due to the slow removal of gas dissolved in the plastic and not to their reaction with molecular oxygen. This property of CO exchange between gas and plastic is important when such materials are used in animal studies of CO production, distribution, or total body hemoglobin estimations involving CO. (Author abstract modified)

638 APTIC NUMBER 16931

Wiedersum, G. C., Jr., W. E. Brockel, and J. D. Sensenbaugh
CORROSION AND DEPOSITS IN LOW-LEVEL ECONOMIZERS. J. Eng. Power, 19o2:313-322, Oct. 1962. 8 refs. (Presented at the Winter Annual Meeting of the American Society of Mechanical Engineers, New York, N. Y., Nov. 26-Dec. 1, 1961, Paper no. 61-WA-138.)

Tests were undertaken to determine suitable coatings, materials, and flue gas treatments for extended-surface type heat exchangers expected to operate at temperatures as low as 166 F. The results of chemical and X-ray diffraction analyses of deposits from treated and untreated units are tabulated, as are the corrosion-penetration rates of ammonia-treated and untreated cast iron and stainless steel strip samples. The data indicate that ammonia treatment of flue gas does not measurably reduce the percentage of sulfur dioxide and results in rather severe deposit problems. Types 304 and 316 stainless steels were the most corrosion-resistant materials tested, but their cost is not economically justified. The corrosion rates of cast iron were moderate, suggesting a normal life for the material. Of the 10 coatings evaluated for cast iron tubes, satisfactory results were obtained only with phenolic coatings. Frequent washing was found necessary to maintain design heat-transfer rates of an operating unit. This is done every two weeks, with the pH of the wash water maintained at normal neutral values.

639 APTIC NUMBER 17264

Abe, Jyun
THE INDUSTRIAL POLLUTION CONTROL AND ECONOMIC PROBLEMS. (Kogai boshi mondai to nihon keizai). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 6(1):29-33, Jan. 15, 1970.

The problem of defining industrial pollution in the context of the future economic development of Japan is discussed, in addition to two prevailing approaches to the problem which are rejected. Of these one uses industrial pollution to oppose economic growth; the other excuses it on the basis of self interest. It may be true that rapid industrial development caused the present pollution phenomenon, but it is much more evident that Japan owes its industrialization to it. Since everyone has benefited from industrialization, the first opinion is an anachronism, denying that civilization makes possible a rise in living standards. The second is irrational, since pollution in its visible or invisible forms, affect every sphere of daily life. Emotional and sentimental reactions to industrial pollution should be rejected in favor of an objective approach to problems. With regard to the control of industrial pollution, the types of controls used in underdeveloped and advanced nations are discussed. In underdeveloped countries, the individual industry assumes responsiblity for control. In a highly industrialized country, it is no longer possible for an individual industry to assume full responsibility, even for pollution abatement with given legislative guidelines. It is evident that Japan falls in the latter category, and that advanced scientific techniques are required to cope with pollution.

640 APTIC NUMBER 17192

Kohn, Robert E.
LINEAR PROGRAMMING MODEL FOR AIR POLLUTION CONTROL: A PILOT STUDY OF THE ST. LOUIS AIRSHED. J. Air Pollution Control Assoc., 20(2):78-82, Feb. 1970. 4 refs.

A linear programming model for air pollution control in the St. Louis airshed is described. It is assumed that air quality goals can be achieved by 1975 by reducing total emissions of the following pollutants to given allowable levels: carbon monoxide, hydrocarbons, nitrogen oxides, sulfur dioxide, and particulates. With the exception of carbon monoxide, the levels are related to air quality goals adopted by the Missouri Air Conservation Commission. The computer solution indicates the set of control methods which achieves the required pollutant reductions at the least total cost. The minimal cost of reducing the five pollutants to permissible levels is $35 million a year. Of this cost, $15 million is for the control of coal burning sources. The use of low sulfur coal proved less important than flue gas desulfurization processes and the substitution of natural gas for coal. The model has a number of limitations, one being that all sources in the airshed are considered equal with respect to location. However, special locational situations can be tested. The model permits re-examination of air quality goals from a cost viewpoint. For example, it is shown that if the allowable level of nitrogen oxides in the airshed were increased 0.1% in 1975, there would be a saving in control cost of $99,000, while the allowable level of sulfur dioxide could be decreased by the same percentage for $9000. These trade-off relationships may be useful to scientists evaluating the relative damaging capabilities of the individual pollutants.

641 APTIC NUMBER 17059

Weber, Herbert J.
THE IMPACT OF AIR POLLUTION LAWS ON THE SMALL FOUNDRY. J. Air Pollution Control Assoc., 20(2):67-71, Feb. 1970.

Various air pollution laws in the United States and Canada are compared and the cost of complying with them for the small iron foundry is discussed. The question of why gray iron foundries do not replace cupolas with electric melting furnaces is answered by presenting an analysis of cupola melting costs and electric melting costs. Gross melt costs for arc melting are 6 to 21% higher and induction melting costs, 8 to 19% higher than cupola melting. The financial plight of the small foundry is typified by the case of five Rhode Island foundries that are required to have collection efficiencies higher than 99%. The net worth of the foundries ranges from $30,000 to $175,000. The installed cost of air pollution equipment comes to $135,000 and combined financing and maintenance costs, to $38,168 per year. However, a breakthrough in cheaper control of cupola effluents appears imminent. A Chicago foundry has obtained a pronounced reduction of the effluents by the use of coke-fired cupolas with natural gas injected just above the tuyeres. The gas burners above the tuyeres deliver 14,000,000 BTU/hr, reducing the amount of coke used by 27%. The system is installed on a malleable iron cupola. Whether it will be successful on a gray-iron cupola remains to be determined.

642 APTIC NUMBER 17193

Woodcock, Kenneth R. and Larry B. Barrett
ECONOMIC INDICATORS OF THE IMPACT OF AIR POLLUTION CONTROL. J. Air Pollution Control Assoc., 20(2):72-77, Feb. 1970. 6 refs.

Because the cost of air pollution controls should be examined relative to denominators common to emitters, desirable indicators of economic impact are those permitting comparisons between emitters. Indicators which facilitate such comparisons are suggested and their usefulness illustrated by application to two model gray iron foundries. Four alternative control systems are proposed for each model plant. The indicators are formed by comparing the investment and annual costs of the control systems to the financial, engineering, and production characteristics of the plants as well as to the effectiveness measures of the control systems. The characteristics of the model are represented by data on the following: investment in melting equipment, plant assets, retained earnings, value of castings, net income, melt rate, control system gas volume, annual quantity of castings shipped, and annual quantity of particulates captured. The indicators permit judgements on the equity and efficiency of various levels of air pollution control and make it possible to obtain a more equitable distribution of costs.

643 APTIC NUMBER 16735

COMMUNITY AIR QUALITY GUIDES. CARBON MONOXIDE. Am. Ind. Hyg. Assoc. J., 30(3):322-325, May-June 1969. 20 refs.

The multi-disciplinary backgrounds and professional competencies within the American Industrial Hygiene Association have been utilized to the fullest in the preparation of this ambient air quality guide for carbon dioxide. To be concise, it is offered as a single compound, recognizing that other factors such as potentiation, antagonism, or other effects associated with mixtures, will create special problems from place to place and from time to time, the effects of which must be individually evaluated. This guide is based on present scientific knowledge. Carbon monoxide's chemical and physical properties, acute and chronic effects on humans, analysis methods in air and blood, and recommended air quality standards are discussed.

644 APTIC NUMBER 16833

Anderson, David M.
AIR QUALITY STANDARDS AND THEIR APPLICATION TO STEELMAKING OPERATIONS. Iron Steel Engr., 46(9):76-85, Sept. 1969.

Air quality criteria and emission standards, and their interrelationship, are discussed as applying to the states of Maryland, New York, and Pennsylvania. The guidelines and standard are applied to specific examples in the steel industry. In most cases the allowable grain loading is less than the commonly used rule-of-thumb quantity of 0.05 gr/scf. It appears on the basis of examples cited that this rule-of-thumb quantity should be adjusted in most design instances to 0.015 to 0.03 gr/scf, equivalent in most of the examples to 99% collection efficiency. For steelmaking processes this can amount to costs of millions of additional dollars. Further studies are underway in the Philadelphia area to develop cost effectiveness relationships such that the greatest reduction in emissions for a region will be accomplished at the minimum total cost to the region as a whole.

645 APTIC NUMBER 16810

Goldsmith, John R.
EPIDEMIOLOGICAL BASES FOR POSSIBLE AIR QUALITY CRITERIA FOR LEAD. J. Air Pollution Control Assoc., 19(9):714-719, Sept. 1969. 23 refs.

In at least some urban areas, population exposure to elevated atmospheric lead levels is associated with increased blood lead. No reasonable alternative explanation exists other than that the increased levels of lead pollution are causing increased lead storage in the body. The study of lead body burdens in U. S. populations indicates an increasing concentration with age in liver, spleen, pancreas, kidney, and lung. No such increase is found in samples of residents from foreign countries. The effect of increased storage of lead on porphyrin metabolism is in urgent need of investigation. Higher levels of lead exposure may interfere with hemoglobin synthesis. Using W. H. O. categories for air quality guides (criteria), a level I criterion for two micrograms of lead per cubic meter of air for a long-term average can be proposed. It would apply to pollution largely derived from motor vehicular sources. (A discussion by Gordon J. Stopps follows the main text.) (Author's Abstract)

646 APTIC NUMBER 16811

Goldsmith, John R. and Seymour I. Cohen
EPIDEMIOLOGICAL BASES FOR POSSIBLE AIR QUALITY CRITERIA FOR CARBON MONOXIDE. J. Air Pollution Control Assoc., 19(9):704-713, Sept. 1969. 49 refs.

Exposures to adequate environmental levels of CO will increase COHb concentrations in human subjects. The amount of this increase is reasonably predictable, and must be considered in relation to exposure to CO in inhaled cigarette smoke as well as to occupational and domestic exposures. The increase in body COHb will result in some degree of impairment of tissue oxygenation. Methods for estimating COHb levels in large populations are relatively simple. The assumption that an exposure to 30 ppm CO for eight hours will produce on the average, an increase in COHb of 5% has been substantiated by available data. Exposure for five hours to between 10 and 12 ppm of CO has been shown to increase the OCHb levels in nonsmokers by at least 0.5%. Such an increase adds appreciably to the body burden of COHb in those who do not already have such a body burden from cigarette smoking. Longer exposures could have produced a somewhat greater increase. Apart from increases in COHb, three possible effects have been a source of major consideration in epidemiologic studies. The first is the production of some persistent toxic reaction. This possibility has been examined with respect to occupational exposure, and the evidence for the occurrence of such a condition is insufficient. The possible contribution of ambient community CO exposure to the mortality of persons hospitalized with myocardial infarction has been investigated. The evidence suggests that daily average CO values in excess of about 10 ppm may be associated with an increase in mortality in hospitalized patients with myocardial infarction. Substantiation of this impression will require a study of the prognosis of myocardial infarction patients in relationship to COHb levels measured at admission to the hospital. Finally, in two studies, persons driving motor vehicles which were involved in accidents had higher COHb levels than "control" populations. Controls were not ideal, however. Possible mechanisms by which CO might affect the ability to drive a motor vehicle is suggested in the available data on CO effects upon visual sensitivity, psychological test performance and accurate estimation of time intervals. As little as 2% COHb can produce these effects in laboratory studies, and the available epidemiologic information confirms that such an increase in COHb levels among drivers might influence the frequency of accidents. Areas where research is indicated to clarify uncertainties relating to health effects of CO are discussed. (Author's Abstract, Modified)

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647 APTIC NUMBER 17201

Hishida, Kazuo
EXPLANATION WITH GUIDES OF COLLECTOR FOR REFUSE INCINERATOR SMOKE. (Gomi shyokyakuro no haien shori shisetsu shido hyojun no kaisetsu). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 3(6):365-372, June 15, 1967.

It is impossible to standardize measures to control incinerator smoke because incinerators are so diversified. For this reason, the Tokyo Metropolitan Environment Planning Office, Air Pollution Control Section, has issued a guide to refuse incinerator smoke collectors, which will enable plants to select or decide on incinerators which are economical but meet operating criteria, or to improve existing units. The choice of an incinerator depends largely on the kinds of refuse burned and the required capacity. In addition, there are many regulations governing stack smoke. The property of smoke dust is determined by incinerator type, operation method, incineration condition, and kinds of refuse. For instance, when refuse bulk exceeds maximum capacity, half-burnt ashes contain toxic gases or an unusual high temperature is registered inside the incinerator. Also, the collector becomes overheated. Incineration capacity is generally decided by operating conditions, which are as a rule subordinate to both regulatory acts and maintenance management. Good maintenance requires that inside temperature be kept at 1000 C during operation and that surfaces of metal fittings be kept at 200 to 350 C. In the case of batch incinerators, refuse should be introduced in spaced intervals and in small quantities. By preventing temperatures from dropping, this technique should improve combustion. Refuse incineration becomes more important as living standards increase. Consequently, advanced methods of condensing wet refuse and sorting refuse before incineration should be exploited.

648 APTIC NUMBER 17269

Japan Environment Council, Dept. of Environmental Disruption
REPORT FROM SPECIAL COMMITTEE FOR AMBIENT STANDARD OF ENVIRONMENTAL POLLUTION BY CARBON MONOXIDE. (Issanka tanso ni yoru kankyo osen no kankyo kijun ni kansuru senmon iinkai hokoku). Text in Japanese. Kenko Kanri (Health Management), no. 184:34-39, Oct. 1, 1967.

The numerical evaluation of carbon monoxide standard density is on a scientifically reliable basis is presented that enables measurements to be made for environmental CO pollution control in the interest of public health. Conditions which are assumed to be decisive in providing direction for CO control from the hygienics point of view are: the discovery of any poisonous symptoms perceived subjectively or objectively, the importance of the removal of CO taken in by a body, whether from the outer environmental atmosphere, from cigarette smoking, or from air-conditioning; consideration of the activities largely dependent on motor vehicles; and the effects of CO on sensitive groups of people. What is deduced from these conditions point to two proposals for controlling CO density in the environmental atmosphere: CO density is to be less than 20 ppm average per hour in continuity of 8 hours and less than 10 ppm in the course of 24 hours. Simultaneous satisfaction of both requirements is noted. These proposals should not be interpreted to imply any conclusions with regards to CO density restriction, since they are of a provisional character aimed only in providing a basis for judging CO density in the environmental atmosphere. Materials concerned with studies of the effects of CO on public health is included.

649 APTIC NUMBER 17041

Penrose, Michael O.
THE AIR FILTER TEST ORGANISATION. Filtration Separation (Purley), 7(1):80-84, Jan.-Feb. 1970. (Presented at the Filtration Society's Conference on Choosing the Right Equipment for Dust Control and Air Cleaning at the Dust Control and Air Cleaning Exhibition, London, Sept. 23-25.)

The background, scope, and objectives of the British Air Filter Test Organization (AFTO) are summarized, and the essentials of a filter test code considered. The AFTO, which comprises over 20 filter manufacturers, will seek to ensure that currently available test methods for defining air filter performance are uniformly applied and that consequent performance data are uniformly declared. The organization supports the B.S. 2831 Test Dust No. 1 code (methylene blue) as well as the B.S. 2831 Test Dusts No. 2 and No. 3 codes, the B.S. 3829 code (sodium chloride), and the A. F. I. test for filter panels. It does not recommend the D.O.P. test (dioctyl phthalate). The proposed method of authenticating test rigs is discussed.

650 APTIC NUMBER 16821

Pierrard, John M.
ENVIRONMENTAL APPRAISAL-PARTICULATE MATTER, OXIDES OF SULFUR, AND SULFURIC ACID. J. Air Pollution Control Assoc., 19(9):632-637, Sept. 1969. 50 refs.

The role of particulate matter and oxides of sulfur in degradation of the atmospheric environment is disucssed. The Federal Air Quality Criteria for these pollutants are analyzed for their conformance with the requirement of the Clean Air Act of 1967 that they reflect the latest scientific knowledge pertinent to the indication of their effects on health and welfare. Visibility reduction by suspended particulate matter is treated and the bases for the criteria issued in the documents "Air Quality Criteria for Particulate Matter" and "Air Quality Criteria for Sulfur Oxides" are examined. The reactions between particulate matter and gaseous pollutants are discussed, along with the impact of particulate matter on modifications of weather processes. Local effects, such as precipitation, are considered. The relationship between pollution by particulate matter and cloud formation is discussed, as are persistence of fog and observation that certain sources of particulate pollution are also sources of ice nuclei. The article is followed with a discussion by James P. Lodge, Jr. and Phillip W. West. (Author's Abstract)

651 APTIC NUMBER 16820

Pitts, James N., Jr.

ENVIRONMENTAL APPRAISAL: OXIDANTS, HYDROCARBONS, AND OXIDES OF NITROGEN. J. Air Pollution Control Assoc., 19(9):658-669, Sept. 1969. 55 refs.

The relationship between criteria, standards, and control of air pollutants involve complex multidisciplinary interactions. Their overall impact on the public health and welfare is directly related to the confidence level held by members of government, industry, and universities in the validity of the data upon which these criteria are based. The Environmental Appraisal section of the preliminary draft of the Air Quality Criteria Document "Photochemical Oxidant" prepared by the State of California, Department of Public Health, is reviewed. In general, it is a thoughtful and extensive effort to present the current status of information concerning the physical and chemical aspects of photochemical oxidant. Suggestions as to how it might be extended, revised or updated are presented along with a brief discussion of two new research areas of possible interest, singlet molecular oxygen as a possible environmental oxidant and the photochemistry of mixed lead halides in the atmosphere. This article is followed with a discussion by Richard D. Cadle. (Author's Abstract)

652 APTIC NUMBER 16751

Pottinger, J. F.
NEW STANDARDS FOR INCINERATORS IN NEW SOUTH WALES. Clean Air (J. Clean Air Soc. Australia New Zealand), 3(1):29-36, March 1969. 6 refs.

The New South Wales Department of Public Health set up an Incinerator Committee two years ago to investigate incinerator practices and to set standards of design aimed at minimizing emissions to the atmosphere. The standards which are presented in full in the article apply to domestic (except single family dwellings), commercial, and industrial incinerators. The incinerator standards are based on up-to-date information on incinerator design and practice. In the standards various types of waste material handled by incinerators have been divided into five groups. Multiple chamber design is recommended for incinerators to promote the complete combustion of all solid and gaseous combustibles. Five classes of incinerators have been defined with specifications given for each class.

653 APTIC NUMBER 17050

Siegmund, Charles W.
LOW-SULFUR FUELS ARE DIFFERENT. Hydrocarbon Process, 49(2): 89-95, Feb. 1970. 6 refs. (Presented to the Air Pollution Control Association, New York, N. Y., June, 1969.)

In the United States, regulations are being designed to meet the level of 0.1 parts per million (ppm) ambient sulfur dioxide concentration on a 24-hr average basis as recommended in two sets of standards which have been issued by the Dept. of Health, Education, and Welfare. The primary action being taken is to limit the allowable sulfur content of the fossil fuels burned in these areas. The two areas most seriously affected by these regulations are California and the New York City area. The normal supplies of residual fuel oil, grades 4, 5 and 6 which have been supplied along the East and West Coast of the United States, will not meet these regulations. These new, low-sulfur fuel oils will have different properties than current fuel oils and will therefore have different handling requirements. The characteristics of Middle East and Venezuelan crude oils and fuels are tabulated. Various installations that can handle almost any type of fuel oil regardless of its characteristics are graphically shown. Blends of natural low-sulfur fuel oils with other higher-sulfur oils will be adequate in some cases to meet more moderate sulfur regulations. In specifying fuel oil for use in a hot-well or separate return system any one of three properties may determine whether the fuel will give satisfactory operability: the pour or flow point, the pumpability, and the yield strength. It is expected that these fuels will be somewhat more expensive than current fuels due to additional processing costs or the cost of transporting fuel to an area not normally tributary to the source.

654 APTIC NUMBER 16812

Whaley, H.
A PROPOSED CANADIAN STANDARD FOR ESTIMATING ATMOSPHERIC DISPERSION OF COMBUSTION SOURCE POLLUTION FROM CHIMNEYS. Atmos. Environ., 3(2):177-195, March 1969. 40 refs.

Rising public concern over the persistent nature of air pollution may be expected to result in more stringent ambient air quality criteria. Hence, until air resource management becomes a reality, there is a requirement for a simple yet reliable method of estimating dispersion of combustion source chimney effluents. To satisfy this need empirical plume rise equation was developed and together with established diffusion equations, it provides the basis for the graphical stack height calculation method described in this paper. The emissions of gaseous and particulate matter are related to heat flux, stack height and maximum ground level pollution concentrations for both a severe atmospheric inversion and a neutral atmosphere. This enables the selection of stack height to be made which should meet any stipulated ambient pollution level. (Author's Abstract)

655 APTIC NUMBER 16128

Zielhuis, R. L.
PERMISSIBLE LIMITS FOR INORGANIC LEAD IN INDUSTRY. (Pripustne hodnoty testu pro anorganiske olovo v prumyslu). Text in Czech. Pracovni Lekar. (Prague), 21(9):396-400, Sept. 1969. 10 refs.

An international occupational health group organized a conference to determine permissable limits for inorganic lead in industry. The following limits were set for a 40-hr week: 70 micrograms of lead per 100 ml of blood; 130 micrograms of blood per liter of urine; 10 mg of delta-aminolevulinic acid per liter of urine; 300 micrograms of coproporphyrine per liter of urine; and 150 micrograms of lead per cu meter of air. Because of the wide confidence limits of the calculations, no undue emphasis should be placed upon a sigle test result. These standards prevent the occurrence of poisoning episodes among adult industrial workers and also prevent long term poisoning even after years of continual exposure. (Author summary modified)

656 APTIC NUMBER 16736

Cleary, Graham J.
A STATUS REPORT: AIR POLLUTION CONTROL IN AUSTRALIA. J. Air Pollution Control Assoc., 19(7):490-496, July 1969. 13 refs.

All but one of the Australian States now have legislation to control air pollution. These are similar in broad principle and rely upon the system of prior approval and the use of emission limits. At the present time Victoria is the only state with legislation providing for the recycling of crankcase vent gases on motor cars. Methods being used to control pollution and future outlook and needs are discussed. At least 65 percent of the crude oil requirements should be met by indigenous low sulfur oil by 1975. This fact and the imminent supply of natural gas to the four major cities and to the centers of heavy industrial development should result in a marked reduction in sulfur dioxide concentrations. A major outstanding problem is the lack of air pollution considerations in planning at regional and local government levels. (Author's Abstract)

657 APTIC NUMBER 17321

Croke, Edward J. and Samuel G. Booras
DESIGN OF AN AIR POLLUTION INCIDENT CONTROL PLAN. J. Air Pollution Control Assoc., 20(3):129-138, March 1970. 7 refs.

To accomplish the transition from a comprehensive but somewhat theoretical concept of air pollution incident control to an array of practical contingency plans, a series of air pollution control tests were initiated in Chicago. The initial effort to develop and field test a prototype operational air pollution incident control strategy was focused on the control of sulfur dioxide emissions from coal and oil burning industrial sources, large commercial and residential structures, and urban power plants. In a series of fixed response emission control tests, participating fuel users alternated between high sulfur fuels and natural gas. Results showed that, in Chicago, operational control of dual fuel power plants is feasible and that switching from coal to oil to natural gas on short notice does not impose a serious operational penalty on most dual fuel users. Fuel consumption records maintained by the participants provided a data base for the refinement of Chicago's emission inventory and the planning of future tests. In a second test series, emission control operations were initiated on the basis of meterological weather forecasts. Communication requirements and the response capability of participating users were noted. The third emission control test was designed as an incident control war game and included a more realistic simulation of the command and control structure, organization, communications, logistical functions, technological aids, and decision processes involved in implementing an incident control program. The control strategies developed were imposed on fuel users and emergency surveillance and enforcement procedures were put into effect. The war game helped to identify deficiencies in the incident control program.

658 APTIC NUMBER 17039

Dunn, Richard L.
POLLUTION CONTROL -- FULL-TIME PROGRAM AT WEIRTON STEEL. Plant Eng., 24(4):66-69, Feb. 19, 1970.

The administration of a steel-producing plant's pollution abatement program is described. Abatement activities, which accomplish the removal of 25 tons of dust from exhaust gases every hour, are directed by a Supervisor of Environmental Control. His staff includes a chemist, environmental engineer, chemical analyst, and chemical supervisor who help locate, identify, and evaluate problem areas and plan for their control. The chemical supervisor also runs the company's effluent sampling and analysis laboratory. Among the supervisor's duties are the evaluation of each day's activities for their possible influence on pollution control efforts, including air and water pollution, industrial hygiene, and solids disposal. It is also his responsibility to advise the engineering division on appropriate control devices, to set levels for plant effluents that will meet or exceed new criteria, and to keep the company informed on all control legislation. The environmental group additionally sponsors a cooperative training program for students. The pollution control education program is extended by encouraging personnel to attend courses and seminars.

659 APTIC NUMBER 17191

Harada, Shozo
COUNTERMEASURES FOR PUBLIC NUISANCE IN TRANSPORTATION INDUSTRY, TODAY AND TOMORROW. (Unyukotsu jigyo ni okeru kogai taisaku no genjyo to kongo no kadai). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(1):39-44, Jan. 15, 1969.

Public nuisances in the field of transportation are ocean pollution caused by emissions from ships; air pollution by auto exhaust-gas emissions; and aircraft and traffic noise. This study discusses these problems and existing and pending legislation aimed at their control. The major sources of ocean pollution are bilge water, ballast water, and tank cleaning water. Thy emissions are subject to several regulatory control measures, but stricter enforcement is required. An act prohibiting oil-bearing emissions except bilge water, from ships has been changed to include bilge water. Future control legislation will stress two points: mandatory oily waste disposal systems and compensation for damage caused by emissions. With regard to air pollution by auto exhaust gas emissions, the effect of carbon dioxide on the human body can not be emphasized enough. At present, engine emissions are controlled only by legislation restricting harmful components to below 3 percent.

660 APTIC NUMBER 17188

Hashimoto, Michio
STATUS OF AIR POLLUTION BY NOXIOUS AND OFFENSIVE GASES AND THEIR CONTROL PROGRAMMES. (Yugai gasu to niyoru osen no genjo to sono taisaku ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(7):441-448, Aug. 15, 1966.

A procedure for the adequate control of noxious gases, some of

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which are not yet covered by legislation, is discussed. Though dust fall is decreasing as a consequence of regulatory control, noxious and offensive gases are increasing in many industrial areas. The Labor Standard Law of 1947 provides for the control of working environments in the interest of worker health, but is no longer consistent with the present state of industrial pollution which poses a hazard for persons living in the vicinity of plants. The 1948 law regulating agricultural chemicals is concerned only with preventing injuries to people and livestock caused by the unrestricted use of chemicals; it does not consider the contribution of the chemicals to air pollution. High pressure gas control, fire prevention, mining, and other laws are subject to the same criticism. What is characteristic of these control laws is that they do not specify total noxious gas emission nor the relationship between a gas and its effect. The Smoke Dust Control Law is intended to compensate for these shortcomings; it now deals with sulfurous gas, anhydrous sulfuric gas with hydrogen fluoride, hydrogen sulfide, selenium oxide, hydrogen chloride, nitrogen dioxide, sulfur dioxide, hydrogen cyanide, carbon disulfide, ammonia, phosgene, and silicon tetrafluoride. More offensive gases are to be covered by the law.

661 APTIC NUMBER 15647

Japanese Office of the Prime Minister, Tokyo
PUBLIC NUISANCE TRANSACTION LAW. (Kogaifunso shoriho). Text in Japanese. Kankocho Kogaisenmon Shiryo (Public Nuisance Gaz.), 8(4):36-43, July 1969.

The Public Nuisance Transaction Law attempts to reach a prompt and fair settlement of pollution problems by forming and authorizing the Public Nuisance Inspection Central Committee to deal with them with the assistance of the municipality and districts organizations. All the problems created by industrial pollution are settled by a compromise or reconciliation as decreed by this organization. The Central Committee is composed of a chairman and four members, appointed by the Prime Minister, who exercise independent authority. Eligibility for these positions is determined by the following factors: involvement in any political activities while in the position; disclosure of any knowledge or secret learned through official duty; holding another wage-producing job are all forbidden, except in special cases permitted by the Prime Minister. The Central Committee can have a professional research staff of up to twenty people to perform investigations. A judgment is passed upon the acceptance of the application presented for arbitration by a party litigant. Before the judgment, the committee has the right to request the attendance of the concerned parties, to obtain all the papers and documents involved, and to enter a plant in order to obtain information for the purpose of pursuing the investigation. Each party is obligated to pay the cost for this procedure.

662 APTIC NUMBER 17316

Kageyama, Hisashi
LEGISLATIVE CONTROL OF AIR POLLUTION BY AUTOMOTIVE EMISSIONS. (Jidosha haikigasu ni yoru taiki osen no boshi ni kansuru hokisei). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(2):78-83, Feb. 15, 1966.

Interpretation of the present status of air pollution by automotive emissions within the context of the Law of Air Pollution Control is discussed. Air pollution by automotive emissions, which constitute the second major pollution source, is controlled by separate legislative actions in three respects. Apparatus involved in the production of smoke dust and odorous and toxic gases is subject to the Law of Road and Carriage Transportation. Under this law inspection of Equipment is mandatory. Driving modes are regulated by the Law of Traffic Regulation under which drivers performance is observed and supervised. The methods which are considered effectual in controlling automotive exhaust gas follow several directions. Quality control in construction is important, since toxic gas emissions increase in proportion to bad engine work, and both CO and hydrocarbon emissions can be decreased 60% by periodical inspection. Because large amounts of gaseous components are emitted during rapid acceleration and deceleration, smooth drive patterns are encouraged in relation to improvement of traffic signals, car road systems, and traffic regulations. The influence of fuel on automotive exhaust emissions is also considered, since their amount, density, and components vary from fuel to fuel. It is evident, however, that the amount of exhaust emission largely depends on engine shape and design. Advances in emission control should result from the investigation of engine systems in the interest of gas purification and not in the interest of horsepower alone.

663 APTIC NUMBER 17287

Kaino, Michitaka, Sachiho Naito, and Jin Sato
ADMINISTRATION AND TECHNIQUE FOR PUBLIC NUISANCE CONTROL. (Kogai boshi no gyosei to gijutsu). Text in Japanese. Horitsu Jiho (Law Review), 41(11):28-38, Sept. 1, 1969.

The characteristics of public nuisance control administration in Japan, the economic development and administrative drawbacks of local self-governing bodies, the disagreeability of public nuisance to the community, public nuisance and industry, and pre-requisites for administrative actions were discussed. The traditional way of approach and the basic attitude of the national administration toward public nuisance control was criticized in relation to the government and the citizen's counterpart. The mutual viewpoint of public nuisance was observed to be high-handed, both with respect to government and citizen; a type of unreasonable reconciliation, in short, the coexistance of a theory of keeping things hidden with silent obedience. This was construed to be a reason why public nuisance control is not started before vast damage is experienced. Consequently, atmospheric and environmental pollutants are discharged according to productive activities. The development of different types of economic theory concerned with production systems was requested. A closed system theory in which pollutants are eliminated and not discharged to the environment is viewed instructive to modern industry; although it may be unattainable. Instead, the development of technical means in which the source of pollutants and refuse is controlled and minimized beforehand in a stage of the manufacturing process is recommended, involving an over-all change in the viewpoint of the industrial production system to which the administrative system responds in controlling public nuisances.

664 APTIC NUMBER 17070

Koda, Masataka
PROGRESS OF PUBLIC NUISANCE LAW, PART I -- REGISTRATIVE PURPOSE AND EXPLANATION OF AIR POLLUTION CONTROL LAW. (Kogai ho no shinten (sono I) -- Taiki osen boshi ho no rippo shushi to kaisetsu). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(9):591-598, Sept. 15, 1968.

Progress made under the Public Nuisance Law and the difference between the original and revised form of the law are discussed. The general purpose of the 1952 Stack Smoke Law was to restrict stack emissions, but restriction was only partially successful. Around 1952, the main contaminants were in general smoke dust and soot; sulfur dioxide matter, including sulfurous gas, was of minor importance. At the present time, because of the energy transition from coal to heavy oil which contains a high proportion of SO2, the problem of pollution control is centered on SO2. Consequently, the Stack Smoke Law was revised to set SO2 emission standards. Aspects of the revised law that are discussed include: purpose, definition, designation of research areas, special emission standards, permissible emission standards for auto exhaust gas, government aid, and penalties. The new law is distinguished by the following goals: to expand research areas, to make emission standards systematic, to set exceptional emission standards depending on circumstances, and to consolidate emergency measures.

665 APTIC NUMBER 17297

LAW OF AIR POLLUTION CONTROL. (Taiki osen boshi ho). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(7):459-464, July 15, 1968.

The text of the Law of Air Pollution Control is presented and additional decisions of the House of Representatives Special Committee for Industrial Pollution Control are covered. The principle objective of the law is to protect national health and to preserve the living environment by controlling both industrial pollution and motor vehicle exhaust emissions. The law also establishes a mediation system to reconcile the conflict of interest between those responsible for pollutants and those who suffer from it. With respect to the determination of emission standards in areas designated by the Ministry of Welfare and Ministry of Industry and International Trade, provision is made for prefectural governors to revise, modify or abrogate some items of the law. Their powers are enumerated under the Smoke Dust Restriction Rule (Chapter Two) which evidently constitutes the most important part of the law. Chapter Two also indicates the obligations of industry, the procedure to be followed in obtaining the approval for stack construction, orders for the improvement of plants and factories, smoke dust measurement activities, and countermeasures to be taken in the event of accidental emissions of specific hazardous substances. Chapter Three cites several rules pertaining to motor vehicle exhaust gas. The mediation system, miscellaneous rules, and the system of penalties are discussed in subsequent chapters.

666 APTIC NUMBER 15635

OFFICIAL RECORD OF THE 61ST DIET FOR THE HOUSE OF REPRESENTATIVES AIR POLLUTION CONTROL SPECIAL COUNCIL. (Dai 61 kai shugiin sangyokogai taisaku tokubetsu iinkai no kiroku). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(6):67-70, June 1969.

A discussion in the Diet about the nature of the House of Representatives Industrial Air Pollution Control Special Council is presented. The inquiries were focused on its legal functions and jurisdiction. The point in question was whether the Council should belong to Article 3 or to Article 8 of the Administrative Organization Law. The difference between Article 3 and Article 8 lies in the independent authority of the former. It is able to make decisions and pronouncements based on its own judgement. For example, the Fair Trade Commission belonging to Article 8 is subordinate to administrative authority, and the Court of Law with regard to making decrees. Its function is to pursue research activities and to make legal decisions, but it is not authorized to control industry. For this reason, its power is much more limited. Furthermore, it is the Ministry of Public Welfare which decides what is considered industrial pollution and what is not. Article 8 has other disadvantages when industrial pollution causes damage to property or to people. The problem is not brought to the Court of Law in an automatic action taken by the administrative office; therefore, the plaintiff must initiate legal procedures individually. It now seems to be the wish of the public that the Industrial Air Pollution Control Special Council be placed under Article 3.

667 APTIC NUMBER 17071

Koizumi, Takao
TO PROMOTE THE DEVELOPMENT OF POLICY FOR PUBLIC NUISANCE. (Sangyo kogai taisaku no genjyo to sono sesaku -- Taisaku no shinten o kishite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(1):27-30, Jan. 15, 1969.

Some ideas are presented for making air pollution control policies effective. The Ministry of Industry and International Trade has issued an act requiring a general survey of industrial pollution to be made in advance of industrial construction. It helps to prevent air and water pollution in advance. More potential pollution areas or districts are to be included in appointed surveys. Among existing methods of preventive research activities, the wind tunnel method prevails. This means that a change in a construction site selected after a prior survey entails modifications or additional surveys that cost extra time, effort, and expense. What is needed in such a case is prompt and rapid calculations, even at the expense of precision. For this purpose, the use of a computer is recommended. Once all available information is memorized by the computer, the presumable change of pollution source due to the change of construction location can be caught. In assessing data, it is important to consider weather and geographic conditions. It is much more essential, however, to check contaminants before they leave a source, or to reduce the air pollution factor. From this point of view, there is in existence a system for removing SO2 from heavy oil, but its

construction involves tremendous expense. Estimated costs are as high as $194,444,444. To lighten the financial burden to the heavy-oil processor, financial aid or loans are to be provided by a government supporting this plan.

668 APTIC NUMBER 13424

Lehmann, A.
A COMPARISON OF METHODS USED IN DIFFERENT COUNTRIES FOR NUMERICAL ESTIMATION OF THE PROPAGATION OF CONTAMINANTS IN THE ATMOSPHERE. (Ein Vergleich der in verschiedenen Laendern in der Gutachterpraxis gebraeuchlichen Methoden zur rechnerischen Abschaetzung der Ausbreitung luftfremder Stoffe in der Atmosphaere.) Text in German. Z. Meteorol., 20(1-6):24-28, 1968. 8 refs.

Using formulas mandatory in the USSR, West Germany, and East Germany, a comparison was made of the results of quantitative estimates of the propagation of contaminants in the atmosphere. It was found that the chimney heights as calculated by the formulas of Bosanquet and Pearson, adopted by the East German authorities in 1966, lie within the limits determined by the formulas adopted by the other two countries for all combinations of input valves that are of interest in practice.

669 APTIC NUMBER 14451

Myers, Frank
NONSENSE AND NIGGARDLINESS ARE UNDERMINING POLLUTION CONTROL. Mod. Mfg., 1(4):184-190, Sept. 1968.

Although federal and local governments have enacted legislation for air and water pollution abatement, they ignore wastes discharged from their own facilities, which are many times greater than the volumes issuing from factories and plants. While prosecuting companies for water pollution, the Metropolitan Sanitary District Commission of Greater Chicago was discharging the waste equivalent of a city of 800,000 people into the Illinois River. In 1967, the Public Health Service reported that one of the worst sources of air pollution in the New York City area was the Piccatinny Arsenal at Dover, N. J. Over 2500 tons of particulate matter and large quantities of SO2 are discharged each year from this installation. Federal facilities in the District of Columbia are among the major air pollution sources in that area, contributing a third of the SO2 and particulate emissions. New Jersey abatement officials list more than 12 federal facilities that are substantial air and water polluters. Approximately 90% of federal air and water pollution comes from Department of Defense installations. Many local governments also pass legislation for pollution abatement, but where their own installations are concerned they fail to comply.

670 APTIC NUMBER 15648

Osaka Municipal Office, Japan, Public Nuisance Office
PUBLIC NUISANCE CONTROL ORDINANCE IN OSAKA PREFECTURE. (Osakafu kogaiboshijorei ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(12):1009-1018, 1035, Dec. 15, 1969.

The Public Nuisance Control Ordinance in Osaka Prefecture, issued in 1965, was revised and a new one enacted in 1969. The revision was prompted by various legislation, beginning with administrative enforcement on the national policy level with the Primary Public Nuisance Control Law, Air Pollution Control Law, and Anti-noise Law. In Osaka, there was a growing necessity to revise the existing ordinance which did not meet the needs of air pollution standards after 4 years of practice. It did not satisfy up-to-date pollution problems for which relevant controls were strongly required in the interest of public health and environmental standards. The old ordinance accounts for the rapid industrial development accompanied by various increasing hazards to public welfare. The contents of the new ordinance are explained, chapter by chapter.

671 APTIC NUMBER 17087

Perman, Robert and Lester Goldner
CURRENT TRENDS IN FEDERAL INTERAGENCY RELATIONS CONCERNING AIR POLLUTION. J. Air Pollution Control Assoc., 15(10):472-475, Oct. 1965.

With the passage of the Clean Air Act of 1963, a major new emphasis has been added to the federal air pollution control program-application of technical knowledge through broadly accelerated control programs. This emphasis is reflected in current trends in the nature and type of the Public Health Service's developing relationships with other federal agencies. The emerging PHS programs to prevent and control air pollution from federal facilities, the PHS role in preventing pollution arising from transportation systems aided under the new Urban Mass Transportation Act, and other developing interagency relationships and problem areas are discussed. In the United States, the primary responsibility for the control of air pollution at its source rests with state and local governments; consequently, the need for and the opportunity to develop a high degree of co-ordination and co-operation among all agencies of local government is particulary great. The possible ways in which this concept might be implemented are enumerated.

672 APTIC NUMBER 11787

Public Health Service, Washington, D. C., National Air Pollution Control Administration
REPORT FOR CONSULTATION ON THE GREATER METROPOLITAN CLEVELAND INTRASTATE AIR QUALITY CONTROL REGION. 45p., Feb. 1969. 6 refs.

In accordance with the Air Quality Act of 1967, urban and engineering factors in the Cleveland area are reported as background for consultation between Federal, State, and local officials, prior to the designation of the air quality control region proposed in the report. The proposed region consists of Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, Stark, and Summit counties in Ohio. Within this region, a T-shaped group of five counties (Lorain, Cuyahoga, Lake, Summit, and Stark) have 92% of the population and form the core of the region: the center of this core is Cuyahoga County, where more than half the population of the full region lives. The three fring

counties are included because diffusion model estimates show that more than half of all three are affected by sulfur oxide concentrations of 0.01 ppm or more and above-background levels of suspended particulates. The three are members of one or more regional planning organizations, and their inclusion in the proposed region will provide a buffer zone along two sides of the Cleveland-Akron-Canton corridor, providing room for the core area to expand within the Air Quality Control Region in the future.

673 APTIC NUMBER 17157

Renninger, F. A.
THE PROBLEM OF FUGITIVE DUST IN THE HIGHWAY CONSTRUCTION INDUSTRY. Highway Res. Rec., no. 173:63-70, 1967. 6 refs. (Presented at the 46th Annual Meeting of the Special Committee on Highway Equipment.)

It is necessary for industries producing contaminants to become familiar with the circumstances surrounding their operations. Airborne dust is viewed as a primary air contaminant and building highways, from production of the raw materials to grading of the finished road, is a dusty operation. Some of the current codes and regulations are summarized and the need for awareness on the part of industry is emphasized. The NCSA's (National Crushed Stone Association) airborne dust monitoring system is reviewed as an example of what has been accomplished by one segment of the highway-oriented industry. This monitoring system may be directly applicable to other situations in the construction industry. (Author summary modified)

674 APTIC NUMBER 17294

Sangyosho, Tsusho
REGULATIONS FOR AIR POLLUTION CONTROL. (Taiki osen boshi no taseno ho kisei). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(4):172-178, July 1969.

The regulational system which forms the constitutional framework in law for air pollution control was explained. Stack smoke emission standards are concerned with the restriction of stack smoke emission sources with designated areas. The emission standard for sulfur oxides is used to determine the total amount of emission at outlets according to the heights of outlets. Judgement of total emission amount is based on the density of sulfur oxides landing on the ground. The theory is based on Satton's Theoretical Dispersion Formula. The determination of responsible counterparts for stack smoke and obligations entailed on prefectural governors who are authorized to take proper steps when necessary through the use of responsible counterparts are to comply with the regulations. Measures to be taken in a state of emergency include such procedures as the announcement of the circumstances by prefectural governors and request of reciprocal cooperation with responsible counterparts in the designated area. Twenty-six specific hazardous substances are restricted under present conditions. Restriction of motor vehicles exhaust gas includes only carbon monoxide. When circumstances are not consistent with the ordinary emission standard in a designated area, a special standard for control of flue gases is applied.

675 APTIC NUMBER 17292

Shiozawa, Kiyoshige
WORLDWIDE STATUS OF AIR POLLUTION CONTROL AND JAPAN'S STANDPOINT. (Sekai no taiki osen boshi no genkyo to wagakuni no tachiba). Text in Japanese. Karyoku Hatsuden (Thermoelectric Power Generation), 20(9):789-795, 1969. 8 refs.

Some aspects of air pollution controls currently practiced in foreign countries appear informative and applicable in a technical and administrative sense to Japan. The present status of air pollution in metropolitan and large industrial cities in Japan is viewed as more serious than in foreign cities. Air pollution is associated with at least three problems. The first is poor-city planning. Excessive centralization of recent population flow into specific metropolitan areas results in a densely populated area which commonly presents a disordered mixture of industrial plants located within residential areas. The second problem is delayed action for regulated control of industrial pollution. Rapid industrial and economic growth, in addition to rapid motorization, is related to administrative drawbacks that Japan was not prepared for. Drastic countermeasures for industrial pollution control are needed. The third problem is little awareness of public mortality and health. Historically speaking, Japan was less aware of public environmental affairs, and this social background results partly in the delayed actions. Considering these aspects, the government is strongly encouraged to reinforce regulated control and to be willing to provide financial aid for research activities as in the United States. As seen in England, funds or financial aid is provided to industries when they are in need of dust collectors or gas removal equipment. It is of particular interest that in West Germany, where there exists a flexible attitude in determining pollutant emission standards for existing plants, the economical aspect is considered separately, though by no means given a priority.

676 APTIC NUMBER 16845

Sholtes, R. S.
RECOMMENDED CURRICULUM FOR TRAINING IN AIR POLLUTION. J. Air Pollution Control Assoc., 19(11):888, Nov. 1969.

Curricula are recommended for training in air pollution at the graduate and undergraduate levels. The course selections and descriptions are intended as a core program for entry into technical and/or administrative activities in environmental control.

677 APTIC NUMBER 16799

Sparrow, Christopher J., A. W. Skan, and R. G. Thom
THE GROWTH AND WORK OF THE AUCKLAND AIR POLLUTION RESEARCH COMMITTEE. Clean Air (J. Clean Air Soc. Australia New Zealand), 3(1):3-12, March 1969. 23 refs.

Some of the important characteristics of the Auckland Urban Area are briefly described prior to a discussion of the formation and organization of the Auckland Air Pollution Research Committee. The work of the committee is described and a summary of the results which have been obtained from its air sampling network is presented. The committee has carried out a considerable amount of research into local meteorological conditions and results to date are commented on. (Author's Abstract)

678 APTIC NUMBER 17258

PUBLIC NUISANCE CONTROL PROGRAM. (Kogai boshi keikaku no sakutei ni tsuite). Text in Japanese. Taiki Osen Nyusu (Air Pollution News), no. 53:2-12, July 1969.

A public nuisance control program for three regions in Japan was presented. Details of the control program were explained. Each of the three regions is characterized by promising development in petroleum refining the petro-chemical industry, production of thermal power, and the iron and steel industry. Considering this background, proper steps were strongly encouraged in a composite and extensive scheme. The goals were divided into four categories: the air pollution category included sulfur oxides, suspended particulates and odors, the water pollution category included a water quality standard for drinking water, river water for fish, river water for other use, and water concerned with the living environment; the noise blocking category dealt with a phone standard in the daytime, morning, evening, and night; and a ground subsidence category. Procedures required for enforcement were concerned with concrete control means for pollutant sources and other means concerning ground use along with living environment consolidation. Precise and valid data obtained by research activities can contribute to the performance of an observation and supervision system. Mutual cooperation must be attained between a party in practice and its counterpart, the regional residents and local autonomy to pursue the program. Adjustment of the program with existing control programs was stated. A marked difference among the three designated regions in the basic purpose and framework of the program was not demonstrated.

679 APTIC NUMBER 17239

Watanabe, Seiichi
ADMINISTRATION AND FINANCE FOR PUBLIC NUISANCE CONTROL. (Kogai gyosei to zaisei). Text in Japanese. Horitsu Jiho (Law Review), 41(11):13-22, Sept. 1, 1969.

Several aspects of pollution abatement are considered. One is the limited ability people responsible for pollutants, notwithstanding the fact that most pollutants originate in productive activities of enterprises. Frequently, polluters are reluctant to initiate industrial pollution control programs because these do not contribute to commercial profits. Secondly, there is a limit to relief obtained. In other words, the sources of pollutants are so numerous that it is difficult to prove who is primarily responsible. Moreover, other factors reinforce many pollution phenomena and cause invisible damage and injury that cannot be calculated in economic terms nor referred to in numerical values. Geographical definition of pollutants is difficult. Abatement programs should undertake to (1) restrict pollutants at their source, (2) provide relief means, and (3) conduct surveys and research correlated with (1) and (2). A 22.1% increase in the 1969 budget for pollution control may be indicative of the governmental attitude. However, the amount is still very limited in that it is found in 0.67% of the general account budget for 1969. The budget makes no provision for public nuisance control by local self-governing bodies. The extent to which national financing will be provided in future years points to the most significant decision the government can make in the area of pollution control.

680 APTIC NUMBER 16200

Yanovskiy, A. G. and Zh. L. Gabinova
SANITARY PROTECTION OF THE ENVIRONS OF A MAJOR CITY. (Sanitarnaya okhrana vneshney sredy krupnogo goroda). Text in Russian. In: Sanitation Measures Against Air and Water Pollution in the Planning of Cities. (Ozdorovleniye vozdushnogo i vodnogo basseynov gorodov). Government Committee on Civil Building and Architecture (ed.), Lecture series no. 2, Kiev, Budivel'nik, 1968, p. 18-23.

The USSR Ministry of Public Health, together with the RSFSR Soviet of Ministers and other interested organizations, studied the problems of pollution in Moscow and its vicinity. Conversion to natural gas fuel for thermoelectric plants has reached 70%, and continues to increase. Some 1500 air pollution sources have been located in Moscow. Up to 20% of the territory of the city is subject to harmful air pollution. Measures are being taken to establish sanitary-protective zones for 37 enterprises; 36 sources are being relocated outside of the city; 36 are modifying their production technology, and 27% are installing control equipment. Measures taken to reduce sulfur dioxide, cloride, and carbon monoxide emission from an aluminum refinery and lead from a wire producing plant are given as examples. Each year 27,000 air samples are taken for analysis.

681 APTIC NUMBER 16750

Rankin, Robert E.
AIR POLLUTION CONTROL AND PUBLIC APATHY. J. Air Pollution Control Assoc., 19(8):565-569, Aug. 1969. 6 refs.

The importance of public involvement in programs of air pollution control has been stressed by a number of writers in the field, most recently by Sterner in his comments to the Third National Conference on Air Pollution. As he points out, public apathy appears to be a critical barrier in the development and implementation of effective control programs. Along the same line, Dixon and Lodge, in a digest of the report of the AAAS Air Conservation Committee, state that, "The best program in the world can fail in the face of opposition or apathy on the part of the public." It is the purpose of this paper to take a more analytical look at this problem, particularly in the light of recent data from an opinion survey in West Virginia. If such apathy exists, effective counter-measures require that we examine it more fully and understand its sources. Collective hand wringing will do little to meet the problem. (Author's Abstract)

682 APTIC NUMBER 17263

Yoshizaki, Seigi and Saburo Kato
SOME CONSIDERATIONS ON THE ENVIRONMENTAL POLLUTION CONTROL PROGRAM IN JAPAN. (Kogai boshi keikaku o meguru ikutsuka no kosatsu). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 6(1):19-28, Jan. 15, 1970.

Beginning with a review of the history of pollution, significance of pollution control in relation to human creativity, the human interaction with nature, and human survival are examined. The presence of pollution is attributed to the destructive effect of human activity on nature; and since man never ceases to be creative, pollution is assumed to be inevitable unless preventive control measures are instituted. Of basic importance are the quantitative and qualitative aspects of human productivity. The interaction between man and nature is divided into three periods. The first period extends from the appearance of man to the Industrial Revolution. During this period, man, started to adjust to his environment, to utilize nature on his behalf. The second period, extending from the Industrial Revolution to the present, is that during which man came to dominate the forces of nature. The growth of material civilization during this period has disturbed the balance of nature. The third period is not yet forseen; it may be characterized by the destruction of both man and nature. In saving nature, man will save himself, since from the beginning he has been able to survive only through balanced interaction with his environment. Unless nature is protected, man's survival itself is in doubt.

683 APTIC NUMBER 13506

Harker, J. H.
THE CALCULATION OF EQUILIBRIUM FLAME GAS COMPOSITIONS. J. Inst. Fuel, 40(316):206-213, May 1967. 20 refs.

Certain new processes can produce a hot gas stream at any temperature in the range 200 to 5000 K and there is a need for a method of calculating equilibrium gas compositions in such systems. Such a method of calculation has been developed. The program is simple, though it could be improved by the use of more recent equilibrium data introduced as a function of temperature; this is essential for any program for calculating flame temperatures. Dissociation reactions other than those considered may become significant especially at higher temperatures. It is possible to correct the results given by the present method to allow such phenomena to be included. This method is best suited for circumstances requiring relatively few calculations and if it is necessary to explore a wide range of conditions or to seek greater accuracy, one of the existing programs designed with this in view would be employed. This program, however, could provide the major portion of a simple method for the calculation of thermodynamic data which is vital to furtherance of the technology of high-temperature systems.

684 APTIC NUMBER 16804

Hunter, William K.
AIR POLLUTION AND CONTROL. Am. Dyestuff Reptr., 58(15):21-24, July 28, 1969.

The scope of pollution control criteria has--and will continue to have--a major effect on the way we live. Criteria for cleaner air are most necessary--and the sooner they are implemented, the sooner the air will reach the quality level we all desire. However, from past experience, we know that if criteria are not practical, they will not be implemented--there will be delays, court cases, and eventually, a change in the criteria, all of which will mean that the air will be of undesirable quality for that much longer. Much of this delay can be avoided if the comments of industry and control equipment suppliers, regarding the practicability of potential criteria, are carefully evaluated. By the same token, industry must assume its proper responsibility for the quality of the air it uses, and must start its planning and implementing now. If this is done, we can achieve our goal of cleaner air at minimum cost. (Author's Summary)

685 APTIC NUMBER 17260

CHEMICAL ASPECTS OF ATMOSPHERIC POLLUTION. (Les aspects chimiques de la pollution atmospherique). Text in French. Ind. Chim. Belge, 34(9):739-744, 1969. 21 refs. (Presented at a Symposium Sponsored by the International Union of Pure and Applied Chemistry, Cortina d'Ampezzo, Italy, July 9-10, 1969.)

The symposium papers to be published in the journal 'Pure and Applied Chemistry' covered the following topics: the toxic aspects of atmospheric pollution and recommended limits on concentrations of 24 pollutants; a method of determining the surface area of very small particles; simple methods of separating aerosols by particle size; the influence of certain substances on the transport of hydrohysable ions; the deletorious effect of fluorides on the flora and, indirectly, on the fauna as well; techniques for sampling, isolation, and quantitative analysis of F compounds; different varieties of 'smog'; a method for correcting benzo(a)pyrene determination for the concomitant benzo(k)fluoranthene; polycyclic aromatic hydrocarbons in the exhaust gas of internal-combustion engines; applications of analytic methods for determining polycyclic compounds; several methods of determination of Pb compounds in air; and a survey of the distribution of traces of pollutants in the atmosphere. Oxygen obtained by distillation of liquefied air is polluted by automobile-exhaust and industrial waste gases. The application of the interface electrode of extremely high sensitivity in air pollution studies and the use of mathematical models in air pollution investigations which would reduce the cost and expenditure of time required for an extensive test program were also covered.

686 APTIC NUMBER 17066

Onda, Masami
THE DESIGN FOR THE HUMAN ENVIRONMENT OF THE 1970'S. (1970 nen dai no ningen kankyo no sekkei). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 6(1):7-12, Jan. 15, 1970.

Air pollution control measures and large-scale city planning in Sweden are considered in terms of their implications for Japan and as the basis for a composite national policy for a highly industrialized nation. By 1985 Japan's population is expected to be 120,000,000 to 123,000,000, with nearly 70% of the people residing in urban areas. This means a population density of 90 persons per hectare. The growth rate of the iron and ore industry will be four times that of 1965; the petroleum industry's five times; and the petrochemical industry's thirteen times. Gross national production in 1985 will be four to five times higher, probably between 130 trillion and 150 trillion yen. The population increase will be nearly 20%, but productivity and gross production, even roughly estimated, will be five times as much. These figures are forcing Japan to make the best use of its small land area and to initiate drastic policies for protecting the human environment. During the 1970's, the most significant goal to be achieved relates to control of air pollution by sulfur oxides, which is expected to increase from 3,137,000 tons in 1967 to 8,263,000 tons in 1985, as calculated in terms of SO2 emissions. Next is the problem of water quality preservation. It is pointed out that, in contrast to western nations, drainage systems in Japan are very poorly organized. The third project is concerned with refuse. Future development of the human environment in Japan will be decided according to the way these three problems are solved on a nation-wide scale.

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687 APTIC NUMBER 16993

Sedan, Jean
MOTIVES AND MEANS OF THE FIGHT AGAINST ATMOSPHERIC POLLUTION.
(Les motifs et les moyens de lutte contre la pollution atmospherique). Text in French. Marseille Med., 102(4):285-291, 1965. 25 refs.

A general review of the subject of air pollution supplementing previous papers on the allergic reactions of eyelids to polluted air on public roads is presented, in addition to a brief description of the principal pollutants, their sources, identification, and effects. The organization of the anti-air pollution agencies at the national and the regional levels in France are presented. The bibliography includes many papers dealing with the ophtalmological aspect of air pollution.

SUBJECT INDEX

The terms listed in this subject index are those that most closely describe the information presented in the abstracts. Instead of the APTIC number, the NAPCA ABSTRACT BULLETIN (NAB) number is used to identify the abstracts. The NAB number is shown in the upper left corner of each abstract. This issue includes NAB numbers 1 - 687, which are tabulated below to facilitate use of the index.

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12374	12419	12433	13424	13451	13463	13506	13542	13573	13607	14451
14456	14582	15469	15626	15627	15628	15629	15631	15632	15633	15634
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